

Understanding Digital Children (DKs)

Teaching & Learning in the New Digital Landscape

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Synopsis

Children today are different! But not just because they mature years earlier than children did even a couple of generations ago. Not just because of the clothes they wear or don't wear. Not just because they dye their hair and style it differently than we did when we were that age. Not just because they seem to have more body parts than we did - which they seem to want to pierce, tattoo, and/or expose.

No, today's *Instant Messenger Generation* has grown up in a new digital landscape. For most of them, there's never been a time in their lives when computers, cell phones, video games, the Internet and all the other digital wonders that increasingly define their (and our) world haven't surrounded them. Constant exposure to digital media has changed the way these Digital Natives process, interact and use information. As a result, DNs communicate in fundamentally different ways than any previous generation.

Meanwhile, many of us, the Digital Immigrants, struggle as we try to come to terms with the rapid change, powerful new technologies and change in thinking that are native to their world - a fundamentally different world than the one we grew up in.

This paper examines the new digital landscape and the profound implications that it holds for the future of education. What does the latest neuroscience and psychological research tell us about how the *Instant Messenger Generation's* brains are being re-wired? What are the implication of this new digital landscape for teaching, learning and assessment of that learning? What will it mean to be educated in the light of this modern, changed, and continually changing world?

How can we reconcile these new developments with current instructional practices in an Age of Standards, Accountability and High Stakes Testing for all? What strategies can we use to appeal to the learning preferences and communication needs of digital learners? Prepare to have your assumptions about children and how they learn severely challenged.

Understanding Digital Children (DKs)

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How many of you have children of your own? Don't be ashamed, you can put your hand up. Now how many of you have teenagers? Be assured that each and every one of you has our DEEPEST sympathies.

Do you ever catch yourself watching children in performance mode and just shaking your head? Do you ever find yourself saying, "What's going on here? What's up with children today? I wasn't like that when I was that age. I wouldn't have DARED say or do that. Why are they so different? What could possibly be going on in that head? What could they possibly be thinking? What's wrong with this younger generation?"

Hold on!

At the same time others might say "Hold on, you're wrong. You're being much too harsh! You need to relax a little. Children are children. They make look different. They may sound different. They may act different. But underneath it all children are just children. They have the same issues, the same insecurities, the same hurt feelings, the same immature ways of looking and thinking about things that we did. They're basically the same way we were when we were that age."

And if you believe this second statement, we want you to know that we totally respect your opinion even if you are completely wrong!

Children today are different

Children today really ARE different! Really different! But not just because children today mature years earlier than children did even a couple of generations ago. Not just different in terms of the clothes they wear or don't wear; not just because they dye their hair and style it differently than we did; not just because their music is incredibly profane, has no rhythm, and is utterly incomprehensible (oops sorry for that editorial comment); not just because of the way they talk or what they say, or how they act; not just because children today seem to have far more body parts than we ever did growing up - body parts that they seem to want to pierce, tattoo and expose.

Different wiring

No, what I'm talking about here is, because of digital bombardment, because of the pervasive nature of digital experiences, children today are also different neurologically.

They have become screenagers. This is the first generation that has actually grown up with a mouse in their hands along with an assumption that that the images on the screen

are supposed to be manipulated and interacted with - that screens aren't just for passive consumption. As a result of this, they're different in the way their brains are wired.

How do we know this? A great deal of brain research, in what is called the neurosciences, has been undertaken in the past few years. This research is validating much of what we suspected from the psychological research, particularly the psychological sciences. The bottom line is that children today are **FUNDAMENTALLY** different from previous generations in the way they think, in the way they access, absorb, interpret, process and use information and above all, in the way they view, interact and communicate in and with the modern world. And this holds *profound* implications for us both personally as parents and professionally as educators. Let's examine **WHY** this has happened and what it means for us.

Growing up in a different world

Most of the people reading this article grew up in a different time. I can only speak for myself, but for me, it was a time of relative stability. For example see how many of these apply to you?

I had **TWO** parents! And here's a radical concept - they were my *original* parents. My father worked at the same job for the same company more than 30 years.

My mother stayed home to take care of the family and manage the house so she was home when we got back from school. These were very different times because just thirty years ago in North America, only one in five families had both parents working outside the home.

For me - for most of my generation, life was relatively stable and predictable. I can remember *literally* being able to set my watch by the time my father turned the corner and came home from work each evening - it was exactly 5:45 PM every night.

We all sat down together for dinner - imagine this - for an actual *home-cooked* meal - with the entire family (including my original mother and father) - at the same time every night - 6:15 PM every night.

And Sundays were special. It started with church in the morning, followed by brunch, then playing outside in the afternoon, Sunday dinner, followed by Disney, Ed Sullivan and then a bath, whether we wanted it or not.

An amazing rhythm

For many of the people of this time and our generation, there was an amazing rhythm, and predictability to life. Change was something that happened, but it seemed to happen *slowly*. And it wasn't just that life was predictable - our lives were also much simpler.

When we came home after school, on weekends, and during holidays, we played with our friends outside on the street, in the backyard or at the park, often until it got dark.

We could do this because our world was relatively safe. Most parents didn't have to worry that something horrible was going to happen to us. Danger didn't seem to be lurking around every corner. This was due, in part, to the fact that there was a sense of community. Everyone looked out for everyone else and everyone seemed to know everyone else's business.

And it was outside, on the street, in the back yard, and in the park where we learned many of our social skills. We worked in groups to solve problems. By turns we lead, we followed, we fought, we reconciled, we negotiated, we planned, we built teams and we learned to get along. And if we fought, it was with our fists not weapons. And this all happened face-to-face, if not in-your-face.

A low-tech world

Our world was decidedly low tech. Do you remember Etch-A-Sketch, Mr. Potato Head or Slinkies? For me, the ultimate in modern technology was my 3-speed Schwinn Phantom bike and a transistor radio I hid under my pillow at night when I went to bed.

Like most other families, we only had one TV. (Why would anyone ever need two?) It was located in the living room. And it was there in the living room where we sat together, as a family, watching our shows on the five available channels discussing what we saw. And if we wanted to see the latest movie, we had to go to a theater or a drive-in.

Imagination

Back then imagination was essential. We created our own monsters and villains. Our stick became a sword. The rock was our horse. We rode our bikes with chunks of cardboard clothes-pinned to the frame so we could sound like a motorcycle. And we drove our parents parked cars by turning the steering wheel while creating our own sound effects.

And because our lives were decidedly low-tech, probably one of the very worst things that could *ever* happen to us back then was to be sent to our room because there was ABSOLUTELY nothing to do in there other than to reflect on our crimes. Do you remember those days?

Basic communications

Back then communications were basic. Many of us lived on a telephone party line we had to share with several other families. Long distance phone calls were expensive and often of poor quality. Letters took days from the time they were sent to when they were received and even longer to be responded to. Telegrams were only used for important events. As a result, whether it was information, goods or communications, we had to learn to wait. We had to learn to be patient.

Limited information

Information was limited. We only had a few radio stations and even fewer TV channels. World events were something we read or heard about, often long after they had taken place. Information was finite because we lived in a largely single source world. This was a world that was primarily made up of text and paper. Most of our information came from newspapers, magazines, books, encyclopedias, and the library. High tech was an 8 mm film, a slide projector, or a hi-fi stereo. Multimedia meant it had a diagram or photo.

And almost nothing happened right away. We had to wait for everything, from information, to decoder rings, Mickey Mouse Club memberships, and mail order purchases.

Doing research

Back then doing research was a physical act. We went to the library and used the Dewey Decimal system to search the card catalog. Then we walked through the stacks, hoping we'd find what we were looking for. If we were lucky enough to locate the right book, we flipped through it trying to find the information we were looking for.

Our primary sources for that information were Funk and Wagnall's, the Webster Dictionary, the Encyclopedia Britannica, the Book of Knowledge, or a textbook. This was information that could be committed to paper because our world and the information in it didn't really change very quickly.

The schools of our youth

The schools of our youth reflected the times we lived in. They were predictable and safe. They were orderly and punctual. Having a weapon at school meant being caught with a slingshot, cork popgun, or peashooter.

What's more, schools had authority. Teachers and administrators were respected. Some students weren't as smart as others, so they failed a grade and were held back to repeat the grade over again. Tests were not adjusted for any reason.

School discipline

Children who misbehaved were dealt with swiftly. Some got detentions while others got the strap, the cane or a ruler. Our actions were our own responsibility. Consequences were expected. And the vast majority of parents supported the actions of the school.

The idea that our parents would rescue us if we got in trouble in school or broke a law was unheard of. But being sent to the principal's office was nothing compared to the fate that awaited us when we got home. Parents and grandparents were a much bigger threat!

We sat in rows. The teacher talked. We were expected to listen. Most information came directly from the teacher or a textbook. The focus was primarily on content recall that was tested with fill-in-the-blanks or multiple choices. And as we progressed through the system, teachers became content specialists.

Communications came through the PA system. Most classrooms didn't have a phone. In many classrooms, the most powerful technology was a piece of chalk and a blackboard. It was a big deal to have a film or filmstrip; and it was absolutely high-tech for a teacher to have an overhead projector and multi-colored pens.

We could go on, but you get the idea. But that was the way it was back then, and in describing the way things were when we were children, we've literally examined the tip of the iceberg.

So what about today?

In more ways than many of us can remember or measure, the world of today is a VERY different place than the one we grew up in. It's a world constantly on the move. It's no longer the stable place we grew up in. In a few short years the concept of family has moved from Father Knows Best to the Simpsons - from Beaver Cleaver to Beavis & Butthead.

The changing nature of families

For example, in North America, during the past 30 years we've gone from 10% to 28% of families being led by a single parent. Beyond that, we now have blended families, inter-racial families, gay and lesbian families, separated by divorce, multiplied by divorce or just about any possible combination you can imagine.

The changing world of living and working

And the everyday world is different. Our rhythm of life is now dictated as much by work schedules as by family needs. In the 1950's both parents worked in only one of five families. And this was typically a five-day workweek. Sundays were sacred.

Today it's one in two families where both parents work, and it's a 24 hours a day, 7 days a week, 365 days a year world of work.

In a 24/7/365 world, routines are harder to maintain. Family meals, family time, one on one time, quiet time, down time, and Sundays are more difficult to schedule than ever. As a result, life today has developed a fast food mentality both literally and figuratively.

Today things are a lot different. In 68% of American homes, the only parent or both parents work in order to make ends meet. According to David Walsh from Media Family, in a week in the life of an average school-age child they spend 1/2 hour with dad, 2 1/2 hours with Mom, 2.2 hours doing homework, 1/2 hour reading for pleasure and more than 25 hours - the equivalent every 7 days of a full time job or week of school - watching TV.

As a result of this changing world, parents today spend 40% less time with their children than parents did just 30 years ago, and much of that time is spent watching TV and movies. The scarcest resource for many families today is not time but attention. Consequently, there's a growing void in children's lives that needs to be filled.

Subtle changes

This isn't an over night trend. There's been a steady progression as parents have had less time to spend with their children. Technology has filled the growing void. It started years ago with the telephone, radio, and TV. It then progressed to videos and video games. Now it's on-line gaming, email, surfing, on-line chatting, cell phones, blogging, texting, and a growing host of other digital experiences.

Today, a growing percentage of children come home from school to no one, because both their parents or only parent are at work. Consequently, many children are literally left to their own devices. But for a number reasons, including safety concerns, instead of playing on the street or at the park, many children now stay inside watching TV or videos, listening to music, playing videogames, chatting on Instant Messenger, blogging, talking on the phone and surfing the Web.

Gadgets as babysitter

In this 24/7 world, these new digital gizmos have become the babysitter, the constant companions, and best friends for many of this generation's children. These devices are increasingly where today's digital generation finds their role models and learn their social skills. Their rooms are filled with people, relationships, interactions and adventures that come through their computers,

phones, and video games. As a result, this generation is equally as comfortable with virtual, screen-to-screen relationships as they are with face-to-face relationships.

Contrast our experiences with theirs

So while for our generation, the worst thing that could have happened was to be sent to our rooms, many children today are completely comfortable nesting in their digital cocoons.

Today's high-tech world

And today's world is decidedly more high-tech than our world was. Eighty-two percent of American children play video games on a regular basis - an average of 8.2 hours a week. As a result, over 70% of dollars spent by children and teenagers on toys are for electronic games.

Today's children have access to and take for granted having access to computers, remote controls, the Internet, email, pagers, cell phones, MP3 players, CDs, DVDs, video games, Palm Pilots and digital cameras. These are tools and toys with capabilities that would have been unimaginable when we were children and even 10 years ago for that matter. And for the Millennium generation, there's never been a time where these digital wonders haven't existed. Consequently they haven't just adopted digital media - increasingly they've internalized them.

A different world

Let's be clear that this is a **FUNDAMENTALLY** different environment than the one we grew up in. It's a 600-channel TV universe. It's a 10,000 station radio universe accessible online. It's an 12,000,000,000 plus page Internet.

Children today take for granted that they can view world events as they occur - as TV mini-series that unfolds before their very eyes. They see history in the making. They watch the collapse of the World Trade Center building, the downfall of Sadaam Hussein, the Sumatran tsunami, the eruption of an Indonesian volcano, or a hurricane in New Orleans, in real time even when many of these events are happening halfway around the world. Consequently, for them the notion of time and distance, which meant so much to us, means very little.

Twitch speed

This generation operates at what Marc Prensky describes as twitch speed. Children accept as normal that they should have instantaneous access to information, goods

and services at the click of a mouse. They expect to be able to communicate with anyone or anything at anytime, anywhere day or night.

Such everyday expectations have led to the death of patience and the emergence of a society increasingly expecting, wanting and demanding instant gratification. This is one of the reasons why it's harder and harder to get children to read today. Reading is a delayed gratification medium while TV, video games and the Web are immediate gratification media.

For example, I recently heard my son Kyler bitterly complain that it had taken him 20 minutes to register for his Spring courses at college, which he was doing ONLINE from his bedroom!!!!

Anyone remember the good old days - the huge lineups and hours long wait to register for university courses? Remember finally getting to the front of the line only to find that the courses you wanted were closed!

The emergence of the Web

Such assumptions and expectations about instantaneous access are the result of a massive shift of information and services to the Web. Today, from a desktop, from a laptop, from a handheld device, or a cell phone, children have instantaneous access to literally every library, every art gallery, and every museum in the world. And more relevant for these children, they also have access to friends, games, music, movies, shopping, cheat sheets, and more than 30,000 online clubs specifically design to attract the Instant Messenger generation.

An MTV mindset

Because they've grown up with not just text-based information, but also images, sounds, and video presented as a single entity, this generation has developed an MTV mindset. For them, this isn't multimedia. For them, as David Thornburg suggests, it's monomedia - it's all just digital 0's and 1's and delivered by a single device. How they're assembled and viewed is entirely up to the viewer/user.

And is you think that Sesame Street had an effect on how kids thought, you can imagine what different effect exposure to MTV, the Internet and video games is having.

A visual world

This digital generation is completely comfortable with the visual bombardment of simultaneous images, text and sounds because for them, such experiences provide relevant and compelling experiences that can convey more information in a few seconds than can be communicated by reading an entire book.

Moreover, these new media are not just designed for passive viewing because increasingly, passive viewing just doesn't cut it. This generation no longer wants just to be the audience; they want to be the actors. They expect, want, and need interactive information, interactive resources, interactive communications, and relevant, real life experiences - which helps explain at least in part the rise in popularity of reality-based shows like Survivor and Fear Factor.

A global trend

It's absolutely critical to stress that this trend does not just apply to those who have access to the latest digital media or the Internet. It even applies to the technological have-nots, the disadvantaged children on the other side of the so-called digital divide, who still have access to video games, cell phones, pagers, MP3 players and a multitude of other digital gadgets. In fact, this trend isn't just unique to North American children, but pervasive around the world, for most children, regardless of socio-economics, culture, race or religion.

For example, the picture below was taken recently in the 300-year old Arab market in Singapore. For someone who has never experienced the Arab market, it's hard to describe the overwhelming sensory experience - the sights, sounds, and smells of the street are absolutely overwhelming. According to the locals, other than electricity and automobiles, the scene is very little different than it would have been three centuries ago.

This picture is of an 11-year-old girl, who is sitting on a bolt of cloth patiently waiting while her mother barbers for fabric. In her hand is a palm-sized wireless device she's using to surf the Web.



So what's the point?

What's becoming abundantly clear is that this new digital generation is very different from our generation when we were growing up. Not just a little different

but **FUNDAMENTALLY** different. They crave access to tools that let them network with their peers or anyone or anything else they choose to interact with. And for them, it's second nature to multitask. They expect, want, and need tools that provide hyperlinks and instantaneous random access that allow them to connect everyone and everything to everyone and everything else simultaneously for instant gratification.

They can be doing their homework, talking on the phone, listening to music, downloading movies, surfing the Web, and maintaining multiple simultaneous conversations on a chat line. And they're still bored. Comparing these experiences to our experiences growing up, these activities have increasingly become their replacement for what we did on the street, the park, and back yard.

Where do they get their values?

Increasingly, today's children's values are not and will not be inculcated by the family, the church or other institutions in either the present or the future. They are and will continue to be developed by the electronic and visual media that they are exposed to. This is where they will learn many of their social skills as they've become increasingly immersed in the new digital landscape.

Going back in time

Make no mistake about it. If we could use a time machine to bring children and teenagers forward from the 60's, 70's or even 80's and immerse them in the world of today, they would find it to be a dizzying if not overwhelming experience. The digital environment in which they are now growing up has shaped today's children. They use digital technology transparently, without thinking about it, without marveling at it, without wondering about how it works.

Digital natives

This is the first generation that has ever mastered a multitude of tools essential to society before the older generations have. They have grown up digital - it's their native tongue. They were born to. It's a language in which they are digitally fluent.

They are DFL, They speak Digital as a First Language. They are, as Marc Prensky describes them, digital natives who have grown up in the new digital landscape. For this generation, there's never been a time when computers, the Web, cell phones, and all of the other digital wonders haven't existed.

What about us?

But most of the people reading this article and most educators grew up in the 60s, 70s and 80s. In much the same way that children today have been shaped by their

world, we were shaped by the predominantly text-based, simpler, predictable, relatively stable, low-tech world we grew up in.

The new digital divide

Most people from our generation and our parents' generations are not digital natives. We don't speak digital as a first language. We're immigrants because we come from the old country. We come from the non-digital world. We come from a time and place before digital technology. And as a result, we have old country traditions & assumptions about the world. As Prensky writes, we're digital immigrants who speak, hear and think digital with an accent. Like all immigrants some of us are better than others at adapting to the ways of the new country, but like all immigrants, we retain some degree of our accent from the old country.

As a result, today, we face a digital divide. Not just one based on the gap between the haves and have-nots, but by one caused by the fundamental difference in the way we grew up.

Living and working in a digital world

You couldn't live or work in another country unless you resided there and learned the language, customs, and culture. In much the same way, to operate today in the new digital landscape, to live, work and communicate effectively, we need more than superficial understanding of this digital landscape. We need a deep understanding of the language, customs, culture and learning styles of our children.

If we don't, when students walk into class and listen their teachers speaking to them, they instantly hear their teachers' digital accent, and for many of them, there's an immediate disconnect.

Consciously or unconsciously, they sense that many of their teachers aren't a part of, not in synch with, and probably don't understand the world the digital natives live in.

Digital outsiders

As digital outsiders, many of our generation, particularly in the over-30's group, are distracted and disoriented by multiple, simultaneous, information sources and random access. We try to use old mindsets to do new things. We need to read a manual, take a course, watch a video, or talk face-to-face like we did in the past so many years ago. And while we may use the digital tools, they're not always intuitive and their use does not always come naturally.

So while they're DFL, we're DSL. We speak digital as a second language. That's why we're digital immigrants. Like all immigrants, some of us are better than others at adapting to the ways of the new country but like all immigrants, we also retain some degree of our accent from the old country.

The thicker the accent, the harder it is to understand and adapt to the new digital landscape. We struggle as we apply old thinking to new ways of doing things, new technologies, new software and new mindsets. And the thicker our accent, the harder it is to be understood by the digital natives.

You know you're DSL when you talk about dialing a number; when you need a manual or course to learn new software; when you use the Internet for information second rather than first; when you phone people to tell them about a Web site; when you print out your email to read it; or print out a report to edit it

Digital natives learn differently

Digital natives on the other hand, pick up new devices and start experimenting with them right away. They assume the inherent design of the devices will teach them how to use a new gadget intuitively. This is because the digital native has adopted a mindset of rapid-fire trial and error learning. They're not afraid of making mistakes because they learn more quickly that way. They use devices experientially, and have no problems getting help online.

Digital immigrants don't understand this

But many digital immigrants just can't conceive how anyone can learn like this. So by the time a digital immigrant has read the table of contents of a manual, the digital native has already figured out 15 things that will work and 15 things that won't. While the digital immigrant is afraid they'll break the device, the digital native knows they can just hit the reset button and do it all over again. In fact, for many digital natives, they see the world as one great big reset button.

Digital immigrants focus on and try to apply the skills learned in another time. And as Steven Johnson points out in "Everything Bad is Good For You", we often don't appreciate the skill development of digital natives skills that children have honed to perfection with years of trial and error practice. For example, how many of you have ever played a video game with a teenager and got absolutely beaten?

What some digital immigrants can't appreciate is that the reason children don't have the same skills and literacies as we do is that there has been a profound shift in the kind of skills used and needed to operate in the digital world. The reason

their skill development is different is because their focus is different. They're developing skills in OTHER areas than we did - skills like game playing, on-line searching, and on-line messaging - and they do all of this simultaneously.

We just don't get it

We fail to understand, let alone esteem or value the skill development digital natives do have. Instead we complain about the skill development they *don't* have. Because digital isn't our native language and because we're immigrants to their world, we unconsciously look down our noses at children who act differently. Digital children have a completely new and different set of skills than the ones we have and value.

We tend to unconsciously assume that their skills not as good and they're not as literate as we are because they don't seem to value or prioritize our literacies. So, instead of embracing the new, instead of recognizing that the world has changed, that it's a new digital world, many digital immigrants complain and remain attached to the old and talk about how much better it was in the old country.

What we've learned in the past few years

Because of this constant digital bombardment, because of the new digital landscape, and the pervasive nature of digital experiences, children today are growing up digital,

And because they have grown up digital, new research is inferring that the brains of the digital generation have and continue to change physically and chemically - translated this means that they're actually wired differently than our generation is. Even though we don't yet fully understand the incredibly complex processes involved in thinking and learning, it's important that we take a closer look at what we have learned.

First, consider that even today, we know more about outer space than we do about inner space. For example, even though the human brain is only 2% body weight, it uses 20 percent of the energy consumed, For what this energy is used, we're still not. Further, research tells us that we come into the world with about 50% of the brain wiring in place to handle critical functions, the other 50% happens after birth.

Growing up a digital immigrant

First, we know from both from the research and from personal experience that learning a first language or even a second language comes easiest to us during our first five years of life. However, for most of us, as we get older, learning a second

language becomes increasingly difficult. It's not that we *can't* learn other languages, but when we do, we tend to have more of an accent and often have problems learning one or more aspects of the new language. Learning a language later in life is just not as easy as learning one early on.

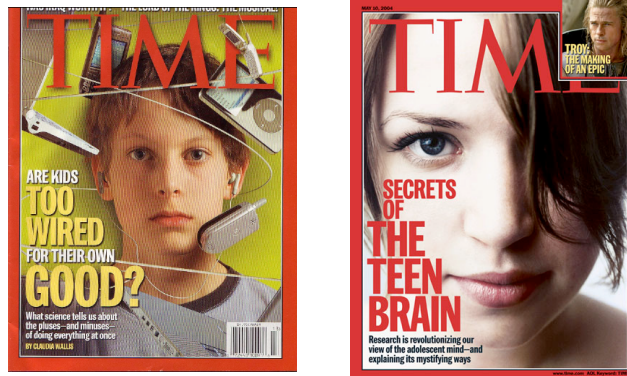
Let's use this observation as an analogy for what's going on with our children in the new digital landscape from the perspective of their internalization of the digital language.

Comparing digital immigrants and digital natives

Most digital immigrants prefer the telephone over IMing and texting, the newspaper over CNN.com, the weatherman over WeatherBug, face-to-face visits over e-mail exchanges, journals over Google, maps over MapQuest, bookstores over Amazon.com, a daily planner over a palm pilot or blackberry, CDs over MP3s, a dictionary over Dictionary.com and still feel more comfortable walking to and around the library over searching online journal databases or Google.

Children really are different

Recently, these were cover stories in Time Magazine:



Their conclusion was that children today are different. In fact, based on what we now know from the neurosciences and psychological sciences, what we're now beginning to understand is that children today are **FUNDAMENTALLY** different than we are in the way they think, in the way they access, absorb, interpret, process and use information, and in the way they view, interact, and communicate in the modern world because of their experiences with digital technologies. If this is

the case, it holds profound implications for all of us personally and professionally. Let's examine what we know.

Conventional wisdom

For the longest time, most neuroscientists believed that different areas of the brain were "hard-wired" shortly after birth to handle different aspects of brain function. Conventional thinking was that by the age of 3, the brain was stable. That from that point on, it really did not change. That by the age of 3 we had a fixed number of brain cells, which then started to die off one by one with no appreciable new cell growth.

As a result, the longstanding assumption has been that we all had fixed memory, fixed processing power, fixed intelligence. That you were essentially stuck with what you were born with. And this was believed to be the case for all brains regardless of race, culture, or experiences. The conclusion was that we all thought in basically the same way because we all used the same neural pathways or brain circuitry to process and utilize information.

What we have learned

But certain cognitive changes, such as recovery from brain injury or stroke, demonstrate that the brain had the capability to change itself given the right conditions. Over the past 20 years, new scanning techniques combined with neuroscience and neurobiological research have demonstrated in one brain area after another and in system after system, that on the contrary, the brain is actually highly adaptive (or "plastic") and remains malleable throughout and that it is constantly reorganizing itself structurally throughout life based on input or experience - and the intensity and duration of that experience.

We know this happens because the research tells us that neural circuits are constantly being strengthened or weakened based on the intensity and duration of the inputs. Brain cells and their circuits operate on a use-it-or-lose-it, survival-of-the-fittest principle.

What this means

What it means in laymen's terms is that you can change memory capacity; that you can change processing power; and that you can re-grow neurons and change neural circuitry throughout your life. And as a result, this means that intelligence isn't fixed. This holds enormous implications ranging from, at one end, being able to enhance cognitive performance, to at the other end being able to arresting or reverse neural disorders.

Teenagers' brains aren't getting bigger as they grow. The brain cells, called neurons, are simply rearranging, making new connections, and pruning unnecessary

ones to speed and reroute the flow of thought. And by the way, it's neuron pruning not hormones that turns many teens weird.

Neuroplasticity

This process of ongoing reorganization and restructuring of the brain in response to intensive inputs and constant stimulation is called neuroplasticity. So contrary to longstanding assumptions, the brain literally restructures neural pathways on an ongoing basis throughout our lives. It makes new cells, it creates new connections, it sets up new circuitry, and, as a result, constantly creates new thinking patterns.

There have been a number of new books written on neuroplasticity and digital children. I've included an extensive bibliography in this handout, but in particular I would recommend *Everything Bad is Good For You* by Steven Johnson.

Johnson argues that the plots of today's video games, movies & TV challenge young viewers to think like grown-ups, follow intricate narratives & analyze complex social networks. As a result, Digital Natives have become VERY sophisticated thinkers -the problem is that the many skills that digital bombardment has enhanced such as parallel processing, graphics awareness, and random access, which are sophisticated and valuable thinking skills that have profound implications for their learning, are almost totally ignored by educators and are not measured by the current school system.

These are the minds of children growing up in non-linear, light and sound-based culture. As a result, Digital Natives, who are accustomed to the twitch-speed, multitasking, random-access, graphics-first, active, connected, fun, fantasy, quick-payoff world of their video games, MTV, and Internet are bored by most of today's education.

In the past few years there has been increasing concern expressed about Digital Natives fascination with multitasking - attending to several things at once. Digital Natives are completely comfortable with the sense of "highway hypnosis"--the ability to drive or multitask with little memory of the process of getting there.

Human beings have always had a capacity to multitask. Mothers have done it since the hunter-gatherer era - picking berries while suckling an infant, stirring the pot with one eye on the toddler. Nor is electronic multitasking entirely new: we've been driving while listening to car radios since they became popular in the 1930s. But there is no doubt that the phenomenon has reached a kind of warp speed in the era of Web-enabled computers, when it has become routine to conduct six IM conversations, watch American Idol on TV and Google the names of last season's finalists all at once.

That level of multiprocessing and interpersonal connectivity is now so commonplace that

it's easy to forget how quickly it came about. Fifteen years ago, most home computers weren't even linked to the Internet. Any number of dire predictions has been made about the long-term effect of multitasking on Digital Natives neural processes. This is not surprising. Ever since the time of Socrates, parents have had trouble dealing with their children - it's not that they're deficient, it's that they're different. Every generation of adults sees new technology, the new thinking behind it, and the social changes it stirs - as a threat to the rightful order of things:

Plato warned (correctly) that reading would be the downfall of oral tradition and memory. And ever since then, every generation of teenagers has embraced the freedoms and possibilities wrought by new technologies in ways that shock the elders and break away from the way that things have traditionally done.

Because most adults (including the critics) can't play the modern complex games themselves (and discount the opinions of the kids who do play them) they rely on secondhand sources of information, most of which are sadly misinformed about both the putative harm and the true benefits of game-playing because how kids now communicate, how kids read, how kids choose to interact with information and others doesn't conform with our traditional definition of literacy.

Another related book is Daniel Pink's "A Whole New Mind". Pink says that we live in linear logical left to right top to bottom beginning to end left-brain society - this is and long has been the mindset behind education. Pink states that the role of the right side of the brain, which handles pattern analysis, big picture thinking, intuition and the like, has long been undervalued, underappreciated & misunderstood in our left-brained society. But what Pink says is that almost anything that involves left-brained thinking can be automated, turned into software or outsourced - and that if our children are going to use both hemispheres together - using the Whole New Mind.

Qualifying this

The caution here is brains don't just change spontaneously. To do this requires intensive, sustained, progressively challenging stimulation and focus over long periods of time. What we're talking about here is several hours a day, 7 days a week.

For example, learning to read and write requires our brains to be reprogrammed over extended periods of time. What we're talking about here is several hours a day, 7 days a week.

In the same way, watching TV for extended periods of time reprograms our brains. But again, this requires several hours a day, 7 days a week.

Does several hours a day, 7 days a week remind you of anything else happening in our children's lives today?

This is increasingly what's been happening to digital children's brains several hours a day, seven days a week since the arrival of Pong in 1974, followed quickly thereafter by SuperPong, Donkey Kong, PacMan, SimCity, Space Invaders. And now it's Madden Football, Grand Theft Auto, Tony Hawk, SimCity, arcade games, and Net-based video games like Halo, Massively Multiplayer Online Role Playing Games (MMORPGs), EverQuest, Second Life and all the rest.

In a recent study undertaken by Jupiter Research, it was estimated that half of all 4- to 6-year-old children and $\frac{3}{4}$ of teenagers play video games - on hand-held devices, computers or consoles several hours a day, several times a week.

As a result, today even amongst our youngest children, regular exposure to the Internet, video games, computers, cell phones and a multitude of other devices that facilitate hypertext, interactivity, networking, random access and multitasking - this digital bombardment is literally wiring and then rewiring kids' brains on an ongoing basis, and particularly enhancing visual memory and visual processing skills.

A new Kaiser Family Foundation study shows that kids are not spending a larger chunk of time using electronic media--that was holding steady at 6.5 hours a day that they were packing more media exposure into that time: 8.5 hours' worth, thanks to media multitasking"- doing their homework, playing a massively multiplayer on line role playing game, talking on the phone, listening to iTunes, watching a DVD and IMing friends all at the same time - and they're still bored.

The bottom line is that these experiences, this digital bombardment, is literally wiring and rewiring digital children's brains so that they process information we do differently than we do.

How do we know this? We know this because of the Human Brain Project.

The Human Brain Project

Which has been ongoing for several years now. During that time, a new field of study called neuroinformatics has emerged. Neuroinformatics involves the digital analysis of brain processes by means of neural scanning and imaging using the incredible number-crunching power of computers and our growing understanding of the chemistry and biology of the brain.

For the first time, using powerful brain scanners and imaging techniques, including functional Magnetic Resonance Imaging (fMRI), Positron Emission Tomography (PET) scans, and OT (Optical Topography) , we can now examine the functions of normal and impaired living brains non-invasively while they are involved in various cognitive tasks.

With these technologies, researchers can digitally view and analyze a living brain's processing patterns at the molecular level in real time and 3D to determine what parts of the brain and what neural circuitry are being used during specific mental processes.

This technology allows researchers to be able to pinpoint to within a few millimeters the parts of the brain that "light up" when people view vivid colors, or react to pictures of calorie-rich desserts, stare at pictures of fearful faces, move a finger, feel sad, add 2 plus 2, or do specific tasks. This technology is helping scientists understand how different areas interact to handle even the simplest of tasks.

As a result of these developments, we've learned more about how the brain operates in the last few years than we did in the previous 100 years.

The cover article of the latest issue of Scientific American Mind is titled The Teen Brain. In it there are some photographs of people of different generations doing specific mental tasks. What the article and the research say is that if you were to take a digital electronic scan of our parents' brains doing a specific mental process and compare it to a digital electronic scan of ours doing the same mental process, we would quickly see that we use SLIGHTLY different neural pathways to process, retain and use the same information than our parents.

But in the same way, if we were to take a digital electronic scan of our brains doing a specific mental process and compare them to those of digital children' brains doing the same process, we would find that they use significantly different neural pathways to take in, process and store the same information we do. We see this particularly in the area at the back of the brain known as the visual cortex.

Consider that the average video game takes about 40 hours to play, the complexity of the puzzles and objectives growing steadily over time as the game progresses. A study by the University of Rochester found that visual processing dramatically increases with as little of 10 hours of gameplay.

According to a recent study out of Toronto, if you were to present 100 photographs to people of different generations, digital natives, those who have grown up in this new digital landscape, would be able to recall about 90% of the images. People of our generations, the digital immigrants, would be able to recall only about 60% of those same images. And people from our parents' generations, who grew up in a primarily audio and text-based world would only be able to recall about 10% of those same images.

Further, research from 3M says that the eye processes and interprets images 60,000 times faster than it does words. This is because the brain is much more suited to processing visual information than anything else. The reason is because nerve cells devoted to visual processing account for about 30% of the brain's cortex, compared to only 8% for touch and 3% for hearing.

If students are more inclined towards visual processing, do you think that this might hold any implications for the way they learn most effectively? Further this study says that because digital natives think graphically, the eyes of digital natives move differently when reading materials.

Their eyes skim the bottom and edges before they focus on the center. And while we find it a distracting to read text of different colors, specific colors attract and repel digital natives when they're reading - blood red draws attention first, then neon green and burnt orange are skimmed - and black is ignored completely. Do you think this finding might have any implications for strategies we might want to develop to teaching of reading?

Both of these findings become even more significant because according to renowned writer Eric Jensen and others, at least 87% of students in any given classroom are NOT auditory or text-based learners, but either visual or visual kinesthetic learners.

They're visual kinesthetic not because they're trying to drive us crazy, but because they've grown up that way in the new digital landscape. They're digital natives who are wired for multimedia.

Yet as Donna Walker Tileston points out, despite this knowledge, at least 85% of the questions on all state exams continue to be based on text.

According to Prensky, by the time they're 21, digital kids will have played more than 10,000 hours of video games, sent and received 250,000 emails and text/instant messages, spent 10,000 hours talking on phones, watched more than 20,000 hours TV and 500,000 commercials.

Almost none of these are experiences our parents or we had while we were growing up. Do you think these experiences, do you think this digital bombardment might have any impact on the way they think - on the way they learn - on the way they view the world?

Because at the same time these digital kids will have spent less than 9,000 hours attending school - less than 5000 hours reading books - and much of that is spent unengaged or under-engaged

Many of the recent findings from the neurosciences validate what we already knew from psychological sciences - things such as social learning theories, the need for context and relevance, the need to make connections to older learning, high challenge, low -threat environments and so on.

However, some of the research has also exposed some widely held assumptions, myths, and simplistic beliefs about learning that can impede learning or that are just plain wrong - things such as gender stereotyping, left-and right-brain learning, enriched environments in early childhood, fixed intelligence, IQ as the measure of all intelligence, that all learners learn in the same way and or that memory fades as we age.

And it doesn't stop there. We all process information in slightly different ways, but with the experiences and stimulation our children have been exposed to, the research is telling us that digital natives are using different parts of the brain to process information differently than digital immigrants. And by the way, we're beginning to see an accelerated gap between the younger generations - between teenagers, tweenagers, and younger children.

Understanding this research helps explain, at least in part, why children are different - why they act the way they do - why they view the world the way they do. And it also helps to explain some of the fundamental differences between their generations and ours.

Despite the fact that there are more than 40 years of solid research on how learners learn best, of how the brain functions, of what instructional models are most effective, this research has not been widely accepted or integrated into most classrooms to better help today's learners and their learning and communication preferences. Nor is it reflected in many of the assumptions that are the foundations of public education today. Let's examine these statements in a little more depth...

Beware of Snake-Oil Salesmen Selling "Mind-Based Education"

These days there's considerable hype being generated around recent neuroscientific findings. Interpretation of these findings have led to the emergence of so-called "brain-based education" models which have become fashionable in many schools and districts throughout North America.

The reason for the hype is in part due to the fact that neuroscience is viewed in some quarters as being far more exciting and sexier than the considerable body of well-established, long-term psychological research. Brain-based education is held up in some quarters as a research-based panacea to many of the ills that beset education.

Excuse me while I rant for a moment, but talking about brain-based education makes just about as much sense as talking about leg-based walking or mouth-based eating! What else should education be, if not brain-based? How about shoulder-based learning? How else do we become educated, if not by using our brains?

It's important to carefully examine the research base of the many so-called "brain-based" educational packages and training being offered to educators. A number of these packages are built on hype, myths and misconceptions that reinforce deeply held erroneous educational beliefs and assumptions about learning. Others are simply psychological research-based sheep seductively dressed up in neuroscientific wolves' clothing.

Gullible, solution-seeking educators and policy-makers desperate for immediate, measurable results buy into such products because research can be twisted around to explain, justify and conversely discredit just about anything. This despite the fact that the hype often is based on isolated or limited research findings that have been glamorized, misinterpreted or misrepresented by overzealous publishers and the media .

There's no need for you become a psychological or neurological-expert complete with all the jargon and details of the brain and mind at your fingertips. However, it is important that you have a basic understanding of how learning actually does occur to in order to ensure that instructional practices are based on well-researched solid theories of learning. You may feel overwhelmed by the research and worry that you're being sold a bill of goods? If you keep the following advice in mind, you won't go far wrong:

"By itself, brain research cannot be used to support particular instructional practices. It can, however, be used to support particular

psychological theories of learning, which in turn can be used to design more effective forms of instruction."

James Byrnes, 2000, p. 185

How we can use current research

What current brain research used in conjunction with psychological research does allow us to do is to make inferences and gain understanding as to why and how our children's experiences with the digital landscape are impacting their brains and minds so we can make good educational decisions.

The bottom line is, if we can't connect with as our children and build relationships with them by understanding their learning and communication practices, and applying this understanding to classroom practices, no amount of energy, money or mandates will increase student achievement or address the challenges of state standards or No Child Left Behind.

What implications does all this hold for schools?

It's long been known that talking and teaching AT students is NOT effective. You may have heard the saying:

I HEAR and I FORGET
I SEE and I REMEMBER
I DO and I UNDERSTAND

We now understand that for information to be remembered it must be moved from our short-term or working memory to our permanent memory. For information to be retained, four things must consistently take place.

Making connections

First, the new information must connect to something the learner already knows & has already made meaning of; or a connection has to be made on the spot. Unless a connection is made, new content only stays in working memory for a few seconds.

This underpins the difference between rote learning and meaningful learning. If it's not meaningful to the learner, the brain will quickly discard it. According to Eric Jensen, we discard 98% of everything that comes into the brain.

For example, have you ever been introduced to someone and INSTANTLY forgotten their name? Or have you ever given students a test on something...and they do really well. And then given them the same test days or weeks later...and it's as if they've never

heard of the material before. This is the difference between rote learning and meaningful learning. Meaningful learning sticks.

Previous knowledge and experience

Secondly, previous knowledge and previous experience determine not only WHAT learners will learn, but also HOW, WHEN, WHERE, AND WHY they'll learn. Consider for a moment the child of a colleague - let's call him Kevin.

Nils is a typical teenager, 16 going on 45. He's bright, affable, articulate, an exceptional reader and fantastic musician - but he's also a chronic C-/D student and he's particularly terrible with Math. If you ask him why he can be so accomplished in some areas and so lousy at school, he'll tell you that the reason why is that schoolwork just doesn't interest him (you probably don't know a kid like this???!!!)

One night Nils comes to me about 10 PM and asks me if I'd like to play some mini-golf. My response was that I'd love to, but it's late so the local mini-golf place was probably closed.

He looked at me shaking his head and then said: "Oh, you're such a last century thinker."

He proceeds to take me out to an on-line mini-golf web site where all of the shots are based on understanding of geometric theory. He's sitting there explaining the difference between right angles, complementary angles, adjacent angles, and supplementary angles and proceeds to apply theoretical geometry to a real life mini-golf task and proceeds to whip me.

For Nils, for the 87% of learners in our classrooms who are visual or visual kinesthetic learners, it's not enough to memorize math formulas; they need to see how the formulas work - how they're applied in life.

This is EXACTLY what Howard Gardner has been talking about for years with respect to multiple intelligences and learning styles. And what's more Gardner writes something that's very important. He says that learning is personal. It's all about the relevance of the learning to the learner not the relevance of the learning to the teacher. And if it's not relevant to the learner, even if it is relevant to the teacher, it will quickly be discarded

Differentiated learning opportunities

Thirdly, learners have to be given repeated, differentiated learning opportunities, distributed over extended periods of time. If kids don't get it when concepts are first introduced to them, we can't just start talking slower and louder.

How do you get better at anything? How did you get better at driving a car, playing a sport, or knitting? By practicing it!

What this means is that children need lots of practice and exposure to the materials in different ways, and from different contexts, and perspectives. Learning just doesn't stick the first time, so you have to provide repeated and differentiated experiences allowing time & context for the ideas to be internalized.

Feedback and reinforcement

Finally, students must be provided with consistent feedback and have their efforts regularly & meaningfully reinforced. According to a videogame developer I talked to recently, games are designed so that players need to make decisions every 1 second, and they are positively reinforced or rewarded every 7 to 12 seconds.

Let's contrast that with how often students are positively reinforced in the classroom and this may explain why some kids are waiting for the Internet or video game version of school to come out so they don't have to come anymore.

Inadequate vs. quality reinforcement

To be clear, this feedback and reinforcement goes well beyond a pat on the back, clapping your hands together, giving a thumbs up or telling someone they did a good job. In fact, if the student knows that they are not doing their best work, and the teacher says "way to go, good job" etc. it can have a *negative* effect on student learning. The kind of feedback that has the highest effect size on student learning would sound something like this:

You've done a really good job of organizing your notes here in small chunks so it's easier to read and to refer back to. I particularly like the way you sequenced this part here with this part here - now here's another idea to help you remember - try underlining a key word in each chunk or drawing a picture that will help you remember the key ideas or concepts.

...

Quality reinforcement always tells children what they're doing right and provides suggestions for improvements.

According to the research, if these 4 things are consistently done, a measurable improvement learning will take place.

The Impact of Media and Technology in Learning

This is absolutely reinforced by a nifty little study undertaken a few years back in Michigan entitled *The Impact of Media and Technology in Learning* that was prepared for the Bertelsmann Foundation. Briefly, two groups of students taught the civil war curriculum. One by traditional lecture means, the other using computers and other multimedia tools. At the end of the study, students in the hypermedia group and a control group of students who had studied the Civil War via traditional classroom methods during the same period of time were given an identical teacher-constructed test of knowledge. No significant test differences were found in the scores between the two groups.

However, a year later, when an independent interviewer unconnected with the previous year's work interviewed the students in the design and control groups, significant differences were found. Students in the control group could recall almost nothing about the historical content, whereas students in the design group displayed elaborate concepts and ideas that they had extended to other areas of history.

Most importantly, although students in the control group defined history as "the record of the facts of the past," students in the design class defined history as "a process of interpreting the past from different perspectives." In short, the "design approach lead to knowledge that was richer, better connected, and more applicable to subsequent learning and events." The entire document can be read at:

http://www.athensacademy.org/instruct/media_tech/reeves0.html

Let's pause for a moment

In summary, for effective learning to take place, for test scores to go up, for learning beyond the test to occur, four things must be consistently addressed.

First, the new material must have meaning for the learner. That's the context of the experience.

Secondly, the teacher needs to understand what knowledge and previous experiences students are bringing into the classroom. That's the relevance of the experience.

Third, students must be provided with repeated opportunities to practice and use what they've learned. That's differentiated practice

And finally, students must be provided with regular & meaningful feedback & reinforcement.

Without these four techniques being consistently used, students will not be able to retain or use new information.

Velcro learning

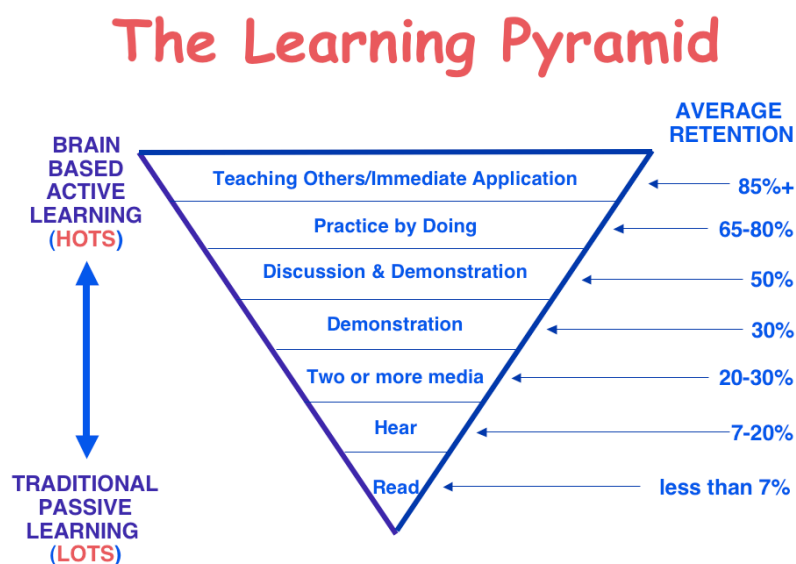
Learning is based on making connections that relate the new to the familiar - nothing makes sense unless it connects to something within us. Learning is like Velcro. An unfiltered fact taught in isolation is not a complete fastener. Only one side of learning is made up of facts; the other consists of stories, ideas and images.

Effective learners make attachments or relationships between their existing knowledge base and new information. Novice learners often just try to remember facts in lists. We all know this is a common strategy for students preparing for quizzes & tests. Information without context, interest, relevance or reinforcement is like having only one side of Velcro, it just doesn't stick. Most of the information is gone in a matter of seconds.

True learning can only occur when the brain can create meaning or relevance by establishing a Velcro connection - through making relevant connections between past experiences and new information. When the two are combined, long-term learning sticks powerfully to the student just like Velcro.

The Learning Pyramid

And this is dramatically supported by research out of years old research out of the National Training Labs in Maine. This is the Learning Pyramid, also known in other studies as the learning cone and the learning triangle:



Adapted from the Learning Triangle, National Training Labs, Bethel, Maine 2003

What their research tells us is that on average we recall:

- less than 7% of the content of what we read,
- 7 to 20% of what we hear,
- 20 to 30% of content simultaneously using two or more media, like looking at pictures or watching a movie
- about 30% of lessons involving demonstration
- about 50% of content that includes interactive discussions & watching demonstration
- 65-80% of content that involves practice by doing like participating in a discussion or giving a talk
- and more than 85% that involves the teaching others as well as the immediate application of learning within the context of a real time, real world task or a simulation of that task

All of this operates on a continuum from passive receiving and traditional learning with a primary focus on LOTS (lower order thinking skills) to active participation and a focus on HOTS (higher order thinking skills).

Standardized tests for non-standardized brains

In the face of this research, we need to acknowledge that we're using standardized, traditional tests to measure increasingly non-standardized brains. We're literally trying to fit round pegs into square holes, and square pegs into round holes.

The vast majority of Ritalin and Adderall given to schoolchildren is to treat an alleged disease called ADHD (Attention Deficit Hyperactivity Disorder). Children who suffer from ADHD are said to be inattentive, impulsive, and hyperactive. They often get bored easily in class, squirm in their seats, are always on the go, or don't get along with other students or the teacher. In other words, many children diagnosed with ADHD may simply be normal kids, full of energy, and bored out of their minds sitting in mind-numbing, public-school classrooms.

They're hyper not because their brains don't work right, but because they spend most of the day waiting for slower students to catch up with them. These students are bored to tears, and people who are bored fidget, wiggle, scratch, stretch, and (especially if they are boys) start looking for ways to get into trouble.

It's not that they're ADD or ADHD, it's that they're just not interested. Their attention spans are not short for everything. Their attention spans aren't short for games or music, or anything else that actually interests them. They have short attention spans for

old ways of learning. As educators we just don't understand how different digital natives are - they're not just a little different.

Today's learners - Digital Natives - are not the learners our schools were originally designed for - and today's learners are not the students teachers were trained to teach

And if we continue to do take approaches to teaching and learning that we know aren't working, then we really have to ask just who has the learning problem?

Consider for a moment that that 50% of the world's population is under the age of 25 years old - then consider what % of teachers are under 25 or what percentage of people in this room are under 25? And because we don't get it, a lot of kids think they have to slow down when they're dealing with us

The bottom line is, that if we want understanding, if we want retention, if we want success on state and national exams, if we want to address and exceed the mandates state, provincial or national curriculum, if we want children to demonstrate proficiency beyond content recall, we can't just lecture at them.

LOTS vs. HOTS

The emphasis in the classroom can't just be on simple data information recall, low level thinking skills, and lots of information - what we call LOTS (lower order thinking skills and LOTS of information).

If we want our children to be successful on the test, if we want them to be successful in life, our emphasis as professional educators has to be on more than just LOTS.

It has to include more emphasis placed upon HOTS, higher order thinking skills and processes, on Bloom's Taxonomy of Higher Order Thinking, on critical thinking, problem solving, project and process based learning, Gardner's analysis of multiple intelligences, and application of best practices based on an emerging understanding about how learning actually takes place.

As Daniel Pink writes in *A Whole New Mind*: Moving From the Information Age to the Conceptual Age by Daniel Pink, there is an emerging world where critical thinking, problem solving, and a deep level of information fluency is increasingly more important than content recall by itself.

Research tells us that people who grow up in different cultures don't just think about different things, they actually *think* differently. As educators we have to understand how truly different our students are. In the past most of the changes we experienced were about style

As we grew up, we saw incremental changes in clothing, language use, body adornments, music, and lifestyle. But for anyone 25 and younger, the changes and differences go far deeper than just style and they are largely driven, by the arrival & rapid dissemination of digital technology in the last decades of the 20th century.

This shift is so fundamental that there's no going back to the way things were. The problem is as educators some of us pay lip service to the notion that this generation is different - we nod our heads but then we shut the door and go back to business as usual - it could just as easily be 1960 all over again.

The bottom line is that we really don't understand their digital world and we never will until we take the time to honor and respect where they come from. But to do this we have to be willing to acknowledge their world and start to educate ourselves and our families about that world.

Start asking kids the right questions - play videogames with them - explore their online world - open a MySpace account, create a wiki, write a blog, learn how to use IM or become a thumbster - and if you have no idea what I'm talking about, you've got lots of work to do. To truly understand them, we need to immerse ourselves in their world - in the new digital landscape.

Watch them, ask them, listen to them, challenge them and more than anything else, respect and honor them, accept their ideas and doing so, we will set them free - and in doing so, we will be able to leverage their digital lifestyle and help them become better, more engaged, more independent learners.

Ask yourself this question - how many of your students would be in your classroom if they didn't have to be? Are they there because they want to be? Or are they there because they have no choice? And what can we do differently to help more students want to be in our classes?

This isn't about you abandoning your long time practice as teachers - and this is certainly not about creating some far-out vision for learning in the future. But at the same time, this is not about continuing to fixate on the world of yesterday. Rather, it's about understanding that the world has changed - that students have changed and therefore that schools must change.

On one hand we need to honor the successful tradition of schools. While at the same time we need to acknowledge that the world has changed and changed children - and that it will continue to change. As a result we also have to acknowledge the different abilities and learning preferences of digital natives.

This isn't, as some people argue, a matter of either-or, us or them, black or white. The starting point for us as teachers is to understand how truly differently digital kids think and learn from the way we think and learn - how differently they view and interact with information = how different their communications preferences are - and use this understanding to figure out what we can do to differently to take advantage of their digital preferences by modifying what we teach and how we teach it

What we must acknowledge

If we truly want to make a difference in the lives of our children, schools must become a place where students are actively engaged in constructing their own knowledge and know how, develop an understanding and the ability to apply key content concepts and ideas, explore dynamically, discover, pose questions and question answers, solve problems, engage in complex tasks that enable them to address essential questions and participate in the processes that make up intellectual accomplishment, tasks that are generally inquiry driven, span different media, link different disciplines, have more than one right answer, multiple routes to each of these answers, an understandable purpose and a connection to the real world outside school.

The context of a significant event provides a frame of reference and relevance for remembering the specific information about what you were doing long after the event. By providing a context for the new information teachers are actually helping students with long-term memory. The power of context to assist with learning is worthy of note for teachers who are struggling to prepare students for large standardized tests. By providing a context for the information teachers are actually helping students learn the material so their short-term recall will be better when they write the test as well as with long-term recall.

Some critical questions

Let's pause for a moment and ask some questions:

1. What implications does this research on the brain, the mind and learning hold for schools?
2. More personally, what implications does this research hold for how teachers do their job?
3. What will students need to know and do to be able to function in the coming ages? What will it mean to be educated in the 21st Century.
4. Does this research have any implications for teachers' roles in addressing the learning and communications preferences of digital children?

What do we see in schools today?

Now let's contrast these findings with what we see in schools & classrooms today.

1. Do our schools, do our classrooms, do our teaching practices reflect the dramatic changes that have taken place in our world during the past few years?
2. Do schools reflect the reality of the world as it is?
3. Do our assumptions about teaching and learning align with the issues raised by this research and this handout?
4. Or do our schools reflect our past, our values, our thinking, our perspectives, our experiences, our comfort zone, or us?
5. Is there dissonance between what was and what is?
6. Is there a dissonance between what is and what should be?

It's déjà vu all over again (Yogi Berra)

Just like 50+ years ago, many students still sit in rows; the full-frontal lecture, oral tradition continues. The current curriculum primarily stresses content without providing a context. In doing so we equip our students with little more than the ability to regurgitate meaningless facts; many teachers still chalk and talk; students are still expected to learn primarily by listening; most information still comes from the teacher or textbook - and while we do have some new technologies most use is generally optional not integral and typically it's used to reinforce old practices and assumptions about learning.

The methodologies underlying the technologies and the methodologies underlying instruction have changed very little from our youth. And most importantly, the focus still remains on content without context and low-level content recall. And today's standards and high stakes testing are simply reinforcing this, making it harder not easier for school to adapt in response to the dramatic changes that are occurring *outside* of education.

As a result it's becoming increasingly evident that there is a fundamental disconnect between the way children think, learn, and communicate and the ways that schools interact with them.

The Condition of Education

This is reflected in startling new data gathered by the Center for Education Statistics (<http://www.nces.org>) a web site often cited as containing the type of research-based resources required to align with the mandates of No Child Left Behind. In "The Condition of Education" the data shows the seriousness of the disconnect between the real world of high-school student & the real world of schools.

According to a report released in February 2004, 6% of white children, 29% of African American & 24% of Hispanic children were at-risk. A new cumulative method of calculating dropout rates has found that only about half of all black, Hispanic and American Indian students who entered ninth grade in 2000 were expected to graduate in 2004. The study, which breaks down data by state, gender and ethnic group, projects the national graduation rate would be just 68% in 2004.

Beyond this, children's views of the relevancy of their school experience to their future lives have declined steadily and dramatically since the late 1980s. According to The Condition of Education, only 28% of 12th-grade high school students believed that schoolwork is meaningful; only 21% believe that their courses are interesting. And only 39% believe that schoolwork will have any bearing on their success in later life.

These statistics are even more shocking when one realizes that these are only the opinions of those students who have remained in high school for four years. The students who find the high school experience the least relevant have already exited the system in huge numbers.

The Carnegie Institute reports that in the largest 32 urban districts in our country, only 50% of students who enroll actually graduate. Each day, they estimate that 2000 U.S. high school students drop out. If their voices were included in the above poll, the profile would be far worse

Taking a closer look

The world of tapes, books, movies and traditional oral presentation is largely linear. Our youth live and thrive in the world of non-linear information access. "Channel surfing," for example, is a popular pastime as our students use the TV remote control to keep up with several programs being broadcast at the same time. We

wonder, as we see an increased incidence of "attention deficit disorder" among young people, whether this malady is real, or if it is merely an artifact caused by the structure of school. If we persist in presenting information in ways that have nothing to do with how our students perceive information, why wouldn't their attention wander?

So when children walk into class at beginning of the year and teachers speak to them, they instantly hear their teachers digital accent - some accents are thicker than others - and there's an immediate disconnect. Consciously or unconsciously, they sense that many of their teachers aren't a part of, not in synch with, and probably don't understand the world digital natives live in.

Why has this happened?

Well, who's in control of education?

We are!

So what's wrong with that?

We are digital immigrants. We come from a land and time before most of the dramatic developments in our world occurred. The schools of today reflect our comfort zone, our experiences, our views of technology, our views of instruction and our views of learning. We have a Polaroid snapshot of the world of then and this is the source of the dissonance. We haven't allowed the institutions of education to reflect the world of today and we're now in the unenviable position of having schools that increasingly reflect a world that does not exist.

And for younger teachers, even though you may have been born into a digital world, your educational institutions modeled a non-digital approach to learning.

And thus schools today largely reflect our edcentric decades old view of how learning should take place.

The methodologies underlying many of our assumptions about instruction have changed very little from our youth. These methodologies reflect non-digital times. The primary focus still remains on content without context, low-level content recall and LOTS.

And if we're truly honest with ourselves, we'll acknowledge that today's standards & high stakes testing are simply reinforcing this focus. And we'll also acknowledge that some teachers are silently delighted because this simply validates the way they've always taught & tested and reinforces the notion that **THEY** don't need to change, it's **THE STUDENTS** that need to change

A Polaroid snapshot

Unconsciously our Polaroid snapshot of the world of then is also the world of now and this is the source of the dissonance. We have not allowed the institutions of education to reflect the world of today and we are now in the unenviable position of having schools that increasingly reflect a view of teaching and learning that does not apply. As a result, it's our view that we are doing a terrific job of preparing children for a world that increasingly does not exist. This is best summarized by Berkeley philosopher Eric Hoffer, a self-educated longshoreman who wrote:

In times of radical change, the learners inherit the earth. While the learned find themselves perfectly equipped for a world that no longer exists...

So who are we as educators?

Are we the learners or are we the learned? More importantly, do we want our children to inherit the earth, or do we want them to be highly educated useless people; children who are good at school but unprepared for life.

Reality check!

The reality is that state standards, high stakes testing and accountability are driving today us for all. "No Child Left Behind" is driving us. We can't ignore these mandates. We can't just pretend they don't exist.

So how do we address the issues of standards, high-stakes testing and accountability while at the same time addressing the growing dissonance between digital children learning and our digital immigrant instructional styles?

How can we ensure that truly no child or teacher is left behind? That no student (or teacher) is left unthinking? This isn't about creating some far-out vision for learning in the future. Conversely, it's not about continuing to fixate on the past - on the back-to-basics mentality that reflects the world of yesterday. It's about understanding that as professionals we must address the issues of standards and accountability on one hand, and the abilities and preferences of digital learners on the other.

If we can do this, we can create truly engaged learning environments that are based on solid and well-established research on learning that will allow us to address both issues simultaneously. The starting point is to understand HOW different we really are from them.

Summarizing the real digital divide...

1. Native learners prefer receiving info quickly from multiple multimedia sources while many teachers prefer slow and controlled release of info from limited sources.
2. Native learners prefer parallel processing and multi-tasking while many teachers prefer singular processing and single/limited-tasking.
3. Native learners prefer processing pictures, sounds and video before text while many teachers prefer to provide text before pictures, sounds and video.
4. Native learners prefer random access to hyperlinked, interactive, multimedia information while many teachers prefer to provide information linearly, logically and sequentially
5. Native learners prefer to interact/network simultaneously with many others
6. Native learners move seamlessly between real and virtual spaces instantaneously - virtual space is any location where people can meet using networked digital devices - chat rooms, blogs, wikis, podcasts, email, discussion threads that come and go - synchronous and asynchronous and with multitasking, can inhabit more than one virtual space at a time - while many teachers prefer to operate in real spaces.
7. Many teachers prefer students to work independently rather than network and interact.
8. Native learners prefer to learn "just-in-time" while many teachers prefer to teach "just-in-case" (it's on the exam).
9. Native learners want instant access to friends, services, and responses to questions, instant gratification and instant rewards while many teachers prefer deferred gratification and deferred rewards.
10. Native learners prefer learning that is relevant, instantly useful and fun while many teachers prefer to teach to the curriculum guide and standardized tests.

This isn't a matter of who's right or wrong

It's not a matter of either/or. This isn't a matter of them or us. It's not a matter of which way is better. The bottom line is that children ARE different. They communicate differently than we do. They're motivated by different things than we are. They process information differently than we do. And most importantly, they learn differently than we do.

To teach effectively today, we need more than superficial understanding of the digital landscape. We need to understand, honor and speak in the language, customs, culture and style of children. This is not about being hip, it's about a

fundamental reconsideration in our approach and understanding of how information is processed, how communication takes place, how information is remembered, what skills are needed to solve problems and operate in this environment.

This requires far more than just a continued reconsideration of our content. We also need to carefully reconsider our methodologies.

So how do we bridge this digital divide?

Teachers must learn to communicate in the native language and style of their students. This doesn't mean changing the focus on what is important or what is going to be measured, but it does mean that we have to change our instructional styles.

1. This requires more making learning fun and more relevant to them and their world.
2. This means going faster so they can receive information quickly.
3. This means less step-by-step instruction and more random access, hyperlinked, just-in-time learning experiences.
4. This means less text and more pictures, sounds and video wherever possible.
5. This means providing more opportunities for multitasking, networking and interactivity.
6. This means applying what we now know from the brain and mind research about learning

This also means understanding that there are now 2 kinds of content

The first is our traditional content - reading, writing, arithmetic, geography, civics, history, languages, the sciences, and logical thinking amongst others. While some of these content areas will become more important as our world changes, others will become less important.

But there is also a second kind of content

What we call 21st century content. This includes critical thinking, problem solving and the structured teaching of process skills, combined with personal life skills, interpersonal life skills, team skills, communications skills, information fluency skills, technology fluency skills, visual fluency skills, biotechnology and bioethics skills. We can't do it all - we have to get rid of some of what is not as important as

it was when we went to school to make room for teaching our digital native learners the skills they need for their future lives.

Fixing education – why do we continue to struggle?

This is a tough one. Education is an emotional subject because we're talking about our children and their future. For that reason, it's essential that the public be regularly reassured that all is well. They need to be left with the feeling that schools are doing a good job and that their children are being well taken care of.

Because of the emotional nature of this issue, educators, politicians and decision-makers spend a great deal of their time encouraging people to believe that their policies and their programs are having a positive effect on schools.

This is why reports on just about everything from test scores to attendance to innovative initiatives to sports programs are designed to put schools and the school system in a positive light. Think about the kinds of information that come from the Department or Ministry of Education. They don't generally focus on the problems.

This approach to addressing the issues is nothing but a façade. A facade that masks the real issues - that masks what's really happening or not happening in schools today - that masks what's actually been happening for a long time.

The problem is that the digital divide has created a fundamental disconnect between students and the schools they attend, particularly as it relates to how and what students are taught as they progress through the school system

The smoking gun is that today in North America, more than 1/3rd of students and almost 1/2 of minorities drop out before they complete high school; and many more of those who do graduate are learning disabled or delayed. What's more, they're increasingly turned off.

According to a recent study only 28% of 12th-grade high school students believe that school work is meaningful; 21% believe that their courses are interesting; and a mere 39% believe that school work will have any bearing on their success in later life.

These statistics are even more shocking when one realizes that these are only the opinions of those students who have remained in high school for four years. Students who have found the high school experience the least relevant have already exited the system in huge numbers.

The generational divide

But it's more than just a matter of disconnect. There's an additional problem – a problem that's invisible to most people. It's the issue related to the real digital divide. It's about more than

the widening gap between the haves and have-nots and the know and know-nots. It's about the generational divide based on the age gap between the digital and the non-digital generations. This is a divide that most people of our generation can't, don't or won't recognize unless they live in that world every day

The digital, interactive, visual world is an experience unlike that any previous generation has ever experienced. And as I outlined earlier, there's strong empirical evidence that digital bombardment is fundamentally altering the way that the digital generation thinks and views the world.

This is something that most adults including many educators just don't understand or accept. That said, it will not be possible for very much longer to engage young people in an educational system where the quality of experiences the schools provide are not as inviting or engaging as the quality of the experiences they get outside of school, through the Internet, computer games, teen magazines, and interactive TV. All of these experiences are designed specifically for them.

This is particularly the case when you compare these experiences to the experiences provided by the existing educational model - a model that was essentially designed for the life and times of 100 years ago.

In addition there is the accountability problem. Many well meaning politicians, parents, and adults understand the critical role that public education plays in a democracy; and they appreciate the critical role that education plays in creating an educated new citizenry and workforce. So with the very best of intentions, they have tried to make the school system better by constantly tinkering with schools and offering the ongoing reform of the day, week or month.

The problem with the reform of the week mentality is that education is a complex issue. These same well meaning people have sought simple solutions to the complex educational issues, and they have done this by deifying content recall and raising test scores.

There are several huge problems with this primary focus on raising test scores. The major emphasis of test score fixation is on LOTS (lower order thinking skills) and short-term recall of information.

Using this approach, students pass the tests, but their retention of the information is short term. Test them at the time, they can remember the content, (maybe) - but test them two weeks later, it's like they've never heard the information before. This is an approach has little long term on real world thinking patterns

More than that, the emphasis on content recall has little impact on real world thinking patterns. Learners are not provided with the opportunities to develop the necessary HOTS that are increasingly required for jobs and dealing with the growing complexity of the digital world.

As Thomas Friedman in "the World is Flat" and Daniel Pink in "A Whole New Mind" point out, computers, high speed communications and a wide range of powerful new technologies are taking over more of the lower level repetitive tasks and allowing many types of jobs to be and allowing many types of work to be automated and/or outsourced.

So at a time when both as a citizen and as a worker our world requires increasingly higher level thought and the application of content to real world circumstances, in schools we continue to focus on lower level thinking. What's wrong with this picture?

The key skill that students develop with a content focused curriculum and associated standardized tests is memorizing information; and while memorization is not a bad thing, as Friedman and Pink note, it's decreasing in importance in the online digital world.

Besides, we've all heard the complaints that students today can't focus and can't remember the names of the states or their capitals. But this same student who can't remember the provinces or their capitals, can clearly, concisely and instantly identify the attributes and abilities of dozens of characters in a multitude of video games or describe the nuances of 100's of Pokemon characters.

So when a teacher asks kids to find and memorize the names of the capitals of the 50 states the student is thinking, "I can find that out any time I want to in seconds on Google." - meanwhile the teacher is thinking, "What's a google?"

It's not that students can't memorize. It's that they can't see the relevance of having to memorize things. They just don't think that way. This is what has lead to the disconnect.

Students have a just-in-time mentality - an "I'll get the information when I need it" mindset. Students are more interested in a general conceptual awareness of the world, not just a factual awareness of the world. In fact our continued fixation and focus on a factual awareness of the world is what has lead to many of our problems.

Beyond this, we live in the Age of InfoWhelm. The amount of information in the world is growing at an exponential rate, which is reinforcing the decreasing importance of memorization, while at the same time increasing the need for a general conceptual awareness of the world.

In light of these developments, the current primary focus on traditional instruction and content-based, low-level recall testing just doesn't make sense and it certainly can't continue. By focusing on content and emphasizing memorization at the exclusion of all else, we are failing our students with the best of intentions

And there's more. If we want to fully understand why students are disconnecting, we also need to acknowledge that the rush towards accountability is forcing teachers to teach to the test, which means that there's a narrowing of focus in the classroom to tasks that are intended to enhance short term memory and content recall - elements that can be more easily remembered. This continued focus is having a disastrous effect

Students are disconnecting because schools are so boring. This is because many of the broader activities that address the conceptual nature of world, the complexity of modern life, and the contradictory nature of being are experiences that lead to more educated citizens. But today, much more engaging activities for students are being dropped because they aren't assessed or are far more difficult to assess.

A focus on test scores says *something* has to go. Teachers aren't stupid. When your evaluation is based on student test scores then HOTS are inevitably the casualty. This narrowing has made the classroom less interesting at precisely the wrong time. At the very same time that research tells us that students are questioning the lack of engagement and relevancy and voting on this lack of relevancy with their feet and minds.

In our rush to accountability, we are losing our students. We're actually making schools less relevant and less interesting for students.

This is an absolute recipe for disaster. In the short term, we get the warm fuzzy that test scores are going up and that therefore schools are accountable - they're doing their job. But at the same time what's lost is interest and engagement in learning. This is a classic example where the operation was a success but the patient died.

The bottom line is that schools must change drastically if we are the reverse this growing disconnect. If we're going to make schools more relevant, there are there are five fundamental changes that need to take place.

First we must shift instruction to the higher level thinking skills needed for the 21st Century. In *A Whole New Mind* Daniel Pink points out that we live in a predominantly left brain society - a society that has long honored linear, logical, left to right, top to bottom beginning to end, piecemeal content recall-based knowledge and analytical thinking. This is the predominant mindset of schools today.

The role of the right side of the brain, which handles pattern analysis, creativity, empathy, big picture thinking, intuition and the ability to combine seemingly unrelated ideas into something new, has long been undervalued and misunderstood in our predominantly left-brained society.

But as Pink points out, just about anything that requires left brain thinking can be automated, turned into software, or outsourced to the third world. Pink says in the emerging world critical thinking, problem solving, and a deep level of information fluency - in other words using both hemispheres - using the whole new mind. It must be emphasized that this is not a matter of either/or - it's a matter of both. Using left brained thinking in conjunction with right-brained thinking will increasingly be more highly valued than simple content recall.

The second point is that we must embrace the new digital reality of the online, computerized world described by Friedman and Kurzweil. But this doesn't and won't happen just because a school has a high-speed network or students have access to laptops or handhelds. Even when hi-tech resources are available, if the resources are used to reinforce old mindsets about teaching and learning and how that learning is assessed, little will have changed.

Outside of schools, the digital world has fundamentally and forever changed the way things get done. This is not just the case for business but for many aspects of our life.

This new digital landscape is allowing students access to information and learning experiences outside the classroom and away from schools. This is access to experiences that have traditionally been solely the domain of teachers and the adult world.

From home - at the mall - whenever and wherever they are, students have access to information, music, original sources and multi-media full motion color images from friends and acquaintances, as well as people who might have diametrically opposed perspectives.

But with our increasing fixation on testing, this means that we're not able to provide them with the guidance and direction they need to develop the essential skills required to effectively use these resources. Instead, students are defining where they go, how they get there and what they do when they get there.

This is compounded by the fact that many adults, because decision makers, and educators are not immersed in the new digital reality of students. We don't have the experience, skills or even the inclination to help them even if we have the time. Schools and teachers persist in using new technologies to reinforce old mindsets. These are issues beyond computers and networks and way beyond testing.

To understand their world we must be willing to immerse ourselves in that world. We must embrace the new digital reality. If we can't relate, if we don't get it, we won't be able to make

schools relevant to the current and future needs of the digital generation.

Third, we must address the shift in thinking patterns that are happening to digital students. They live and operate in a multimedia, online, multitask, random access, color graphics, video, audio, visual literacy world.

As Steven Johnson points out in *Everything Bad is Good For you*, these new literacies are generally not valued, not recognized nor addressed in our schools because they do not represent our traditional definition of literacy.

The starting point is to understand how much differently they learn from the way we learn and then to reconsider what we can do to modify what we teach and how we teach it and how we assess learning.

Let's summarize once more what writers like Steven Johnson, Marc Prensky, Daniel Pink, and others say about the learning styles of digital learners

Digital learners prefer receiving information quickly from multiple multimedia sources. Many teachers prefer the traditional approach of slow and controlled release of information at conventional speed and from limited sources.

Digital learners prefer parallel processing and multi-tasking. Many teachers prefer singular processing and single or limited tasking.

Digital learners prefer active, engaged learning. Many teachers have more experience with passive learning such as lectures.

Digital learners prefer processing pictures, sounds and video before text. Many teachers prefer to provide text before pictures, sounds and video.

Digital learners prefer random access to hyper-linked multimedia info. Many teachers prefer to provide new info linearly, logically and sequentially.

Digital learners prefer to network simultaneously with many others. Many teachers prefer students to work independently before they network and interact.

Digital learners prefer to learn "just-in-time". Many teachers prefer to teach "just-in-case"

Digital learners prefer instant gratification and immediate rewards. Many teachers prefer deferred gratification and delayed rewards.

Digital learners prefer learning that's relevant, instantly useful, and fun. Many teachers feel compelled to teach to the curriculum guides and standardized tests

The problem is that in the minds of some well-meaning policy makers and many parents, achievement simply means raising test scores in basic skills. But mastery of only the basic skills - reading, writing, and arithmetic - the traditional literacies - is absolutely insufficient preparation for the modern world.

In fact, this emphasis exclusively on the traditional literacies at the exclusion of all else may exacerbate students' alienation from schooling.

We must provide a second kind of content to prepare them for the world ahead and to provide them with the skills that they will need to master a world of constant change.

These includes critical thinking, problem solving and the structured teaching of information processing skills, reading critically and speaking and writing persuasively, being able to apply mathematical and scientific principles to solve real-world problems, and being able to weigh current events through the lens of the world's great cultures.

They also must be able to mine the World Wide Web effectively and efficiently and understand the meaning embedded in charts, graphs, audio, video, and animation. They must experience new approaches to learning that are inquiry-based, collaborative, and perhaps, virtual combined with personal life skills - interpersonal life skills - team skills communications skills - information fluency skills technology fluency skills visual fluency skills and much, much more

Getting students to do well on our tests is just like stepping on the first rung of a ladder. We absolutely need to go higher up the ladder and if we go higher, we will meet and easily beat any and all of the elements of accountability for more students more of the time while at the same time recognizing the shift in thinking patterns that is happening to digital students

Fourth, we must broaden evaluation to encompass activities that provide a complete picture of students learning.

As management guru Tom Peters says "what get measured gets done" and conversely "what doesn't get measured doesn't get done" - it's imperative that we begin to measure more than information recall

Dave Masters uses this analogy: "you can get a good picture of a person's health by taking their height and weight but would you go to a doctor who only took your height and weight and said here's a picture of your health. The answer of course is no. It would require a battery of tests - urinalysis, blood tests, blood pressure, cholesterol, checking for lumps and so on to get an accurate picture of your health."

However schools act like the doctor who only takes height and weight and then says here's a complete picture of your health. We test students using standardized instruments that measure inform recall and low level understanding and then say here's a complete picture of a student's learning which is absolutely not the case.

A complete picture of student learning would also include portfolios of performance, demonstrations of the application of theory to solve real world problems and the like.

It's presumptuous for us to say that current test scores are a complete indicator of student learning. This is part of the façade - in fact, content-based test and test scores are only a small aspect of learning.

And finally, we must increase the connection between instruction in schools and the world outside if we hope to increase the relevancy of the learning that takes place. The key point here is that the students must perceive the relevancy of what they're learning. They need to understand not just the content but also the context of that content and how that content is used in the world outside of schools.

For this to happen, schools need to become far less insular. But for this to happen, we need to systematically work to bring the outside world into our schools while at the same time sending our schools into the community. New technologies and an understanding of the new digital landscape can help us do that. The online world creates virtual highway and virtual hallways to both the local and the global community

If we want to unfold the full intellectual and creative genius of all of our children - if we want to prepare them for the new world that awaits them - if we want to help them prepare for their future, not our past - if we are going to march through the 21st Century and maintain our tradition of success. If we want our children to have the relevant 21st century skills - we must create a bridge between their world and ours.

The bottom line is that there needs to be fundamental shift in how teaching and learning takes place in schools. We must look for alternatives to the traditional organization of schools. We need to reconsider our longstanding assumptions about teaching and learning, about what a classroom looks, where it is, the resource that used to support it. We need to reexamine the use of time - the length of the school day and school year, the school timetable, and we need to re-examine the traditional methods used of instructional delivery and consider the potential of online, web-based, virtual learning that can be used to augment, extend, and transform the role of the traditional classroom teachers.

If we want to unfold the full intellectual and creative genius of all of our children - if we are going to march through the 21st Century and maintain our tradition of success - if we want our children to have the relevant 21st century skills - we must create a bridge between their world and ours

School must make it happen for millions of children in the Digital Age. Educators take the pieces of world and put them together so our children can feel whole. Teachers stand in gap between the present and the future - between failure and fulfillment.

It's your energy, creativity, commitment and hard work every day that builds the bridge so children can cross the gap between now and the future. As they do, so does an entire nation. You are your country's greatest hope and most important professionals.

Man alone is the architect of his destiny. The greatest revolution in our generation is that human beings by changing the inner attitudes of their minds, can change the outer aspects of their lives.

William James

The world we have created is a product of our thinking. It cannot be changed without changing our thinking.

Albert Einstein

SOME BOOKS YOU SHOULD READ

THE BRAIN, MIND, & LEARNING

Everything Bad Is Good for You: How Today's Popular Culture Is Actually Making Us Smarter

By Steven Johnson

In his new book *Everything Bad Is Good for You: How Today's Popular Culture is Actually Making Us Smarter*, social critic & technologist Steven Johnson argues the plots of today's video games, movies & TV challenge young viewers to think like grown-ups, follow intricate narratives & analyze complex social networks. Johnson, a regular contributor to *Wired* magazine, points out despite popular belief that electronic media is "dumbing down" society, IQs in the developed world have risen three points a decade for the past 100 years.

For Johnson, pop culture is like algebra class. Whether you remember the quadratic equation as an adult is less important than whether you learned the analytic thought processes that solving equations teaches. Likewise, for Johnson, what matters about pop culture is not its message but whether it forces you to engage in complex thought, analysis & reasoning.

His conclusion: it does, & shockingly well. Today's pop culture, he writes, builds on rules established by earlier pop culture (as, say, *The Simpsons* complicated the sitcom genre). And new formats such as DVDs make audiences more receptive to complex creations that reward repeat viewing or playing. A traditionalist could say that new media are simply good at teaching children to use new media, but Johnson argues persuasively that they also force children "to think like grownups: analyzing complex social networks, managing resources, tracking subtle narrative intertwining, recognizing long-term patterns."

If you are struggling to understand Digital Children, this is a great read!

A Whole New Mind: Moving from the Information Age to the Conceptual Age

by Daniel Pink

We live in left brain society - a society that has long honored linear, logical, left to right, top to bottom beginning to end, piecemeal content recall-based knowledge and thinking. This is the world and the mindset of No Child Left Untested.

The role of the right side of the brain, which handles pattern analysis, big picture thinking, intuition and the like, has long been undervalued and misunderstood in our right-brained society. In fact, at one time the right brain was considered to be the 2nd rate side of the brain.

But as Pink points out, just about anything that requires right brain thinking can be automated, turned into software, or outsourced to the third world. Pink talks about our emerging world where critical thinking, problem solving, and a deep level of information fluency - in other words using the whole new mind - is increasingly more highly valued than simple content recall. Just as information workers surpassed physical laborers in economic importance, Pink claims, the workplace terrain is changing yet again, and power will inevitably shift to people who possess strong right brain qualities.

His advocacy of "R-directed thinking" begins with a bit of neuroscience tourism to a brain lab that will be extremely familiar to those who have read Steven Johnson's *Everything Bad is Good For You*, but while Johnson was fascinated by the brain's internal processes, Pink is more concerned with how certain skill sets can be harnessed effectively in the dawning "Conceptual Age." The second half of the book details the six "senses" Pink identifies as crucial to success in the new economy—design, story, symphony, empathy, play and meaning—while "portfolio" sections offer practical advice on how to cultivate these skills within oneself.

Secrets of the Teenage Brain: Research-Based Strategies for Reaching & Teaching Today's Adolescents

by Sheryl Feinstein

Let's face it—the weather is more predictable than the average teen. Suddenly, even the brightest and most cooperative students become argumentative and distracted. The good news is there are ways you can navigate these abrupt shifts and still be an effective teacher. Recent neuroscience findings have revealed that the teenage brain is actually undergoing developmental changes that can cause extremely erratic behavior. Although you can't change these behaviors, this book demonstrates ways you can adapt your teaching style to effectively reach and teach teens.

The first chapter of this lighthearted but informative book, explores the biology of the teenager's brain. Then, chapters two through six answer questions about specific characteristics of the teenage brain that seem most puzzling to teachers and parents—changes in cognition, the need to socialize, difficulty communicating ideas and feelings, building a self-identity and why some teens engage in risky behavior. You'll be entertained by the accounts of real-life experiences (you might recognize these teens from your classroom!) and then enlightened by the research-based teaching strategies for managing their everyday difficulties, conflicts and crises. With the proper tools, teaching teens has never been more rewarding!

Joystick Nation: How Videogames Ate Our Quarters, Won Our Hearts, and Rewired Our Minds

By J. C. Herz

Here is a look at an essential part of American youth that goes beyond a mere chronicle to engage all of the political, social, and cultural implications of video games. Herz (Surfing the Internet, 1995) eschews a historical point of view for a free-associating meditation on the video game culture that, by her calculations, has engulfed one-fifth of our population. Of course, not being able to dispense with the historical aspects of her subject entirely, Herz offers up ``A Natural History of Videogames'' timeline: The first video game was actually created in 1962 by some MIT graduate students; thus, Herz notes, ``If the history of videogames were a twenty-four-hour day, Pong would arise at 6:37 a.m.'' And in tracing the trajectory from Pong to Doom, she evokes such ``classics'' as Q*Bert, Space Invaders, and Pole Position. Equally clever is her sardonic suggestion to right-wing critics of video game violence that they turn it to their advantage with an ``Operation Rescue level of Doom, where you gun down abortion doctors'' or even a video game version of an all-out military operation. ``But, then,'' she remarks, ``been there, played that. Gulf War.'' (Anyway, she observes that in most video games, violence is perpetrated by teenage boys and girls playing, not criminals, but law-enforcement officers.) Herz adroitly examines the gender gap in video game development, citing political feminists' scholarly critiques of Ms. Pac Man and Frogger, and her research shines in her strong study of characterization in video games, as she traces the connections between Japanese comic-book anime and the popularity of a certain Italian-American plumber named Mario. This otherwise smart and entertaining read ends a bit too abruptly during a discussion of how computer simulation approximates reality. Nevertheless, Joystick Nation will please its citizenry.

The New Brain: How the Modern Age Is Rewiring Your Mind

By [Richard Restak](#)

Pity the poor neurologists of yesteryear, saddled as they were with their conviction that our brains are hardwired after childhood. Then celebrate today's scientists, who are exploiting brain-imaging technologies to show that our brains are capable of profound and permanent alterations throughout our lives. Neurologist Richard Restak does just that in *The New Brain: How the Modern Age Is Rewiring Your Mind*, even as he argues that we are being negatively altered by the sound-bite, techno environment in which we live. Technology such as functional magnetic resonance imaging, Restak begins, can now demonstrate that as a musician practices for many hours, certain neural pathways are strengthened. He then moves to a profound implication, namely that all kinds of technological stimuli are forging brain circuits that may hurt us instead of helping us. For instance, he cites correlations between positron emission tomography scans of violent people and normal experimental subjects who are simply thinking about fighting, then asserts that repeated viewing of violence on television and in video games can set

up brain circuits that make us more likely to initiate real world fistcuffs. Unfortunately, such brain imaging may leave more questions than answers. As Restak himself points out, the technology does not provide "neurological explanations," just "important correlations." Yet he is whipped up enough to diagnose all of modern society with attention-deficit hyperactivity disorder, the probable result of brain changes we are initiating in our media-saturated world. He reminds us of the antidote, though: we are still in control of what we allow ourselves to see and hear. In the end, Restak fails to create a sense that scientists have revealed a new way of understanding the brain. And the images that inspire speculation in the book still await research that may finally reveal the mechanisms of such phenomena as memory and aggression.

What Video Games Have to Teach Us About Learning and Literacy

By James Paul Gee

James Paul Gee begins his new book with "I want to talk about vide games--yes, even violent video games--and say some positive things about them." With this simple but explosive beginning, one of America's most well respected professors of education looks seriously at the good that can come from playing video games. Gee is interested in the cognitive development that can occur when someone is trying to escape a maze, find a hidden treasure and, even, blasting away an enemy with a high-powered rifle. Talking about his own video-gaming experience learning and using games as diverse as Lara Croft and Arcanum, Gee looks at major specific cognitive activities:

- * How individuals develop a sense of identity
- * How one grasps meaning
- * How one evaluates and follows a command
- * How one picks a role model
- * How one perceives the world

This is a groundbreaking book that takes up a new electronic method of education and shows the positive upside it has for learning.

Mind Wide Open: Your Brain and the Neuroscience of Everyday Life

By Steven Johnson

Using a mix of experiential reportage, personal storytelling, and fresh scientific discovery, Steven Johnson describes how the brain works -- its chemicals, structures, and subroutines -- and how these systems connect to the day-to-day realities of individual lives. For a hundred years, he says, many of us have assumed that the most powerful route to self-knowledge took the form of lying on a couch, talking about our childhoods. The possibility entertained in this book is that you can follow another path, in which learning about the brain's mechanics can widen one's self-awareness as powerfully as any therapy or meditation or drug.

In *Mind Wide Open*, Johnson embarks on this path as his own test subject, participating in a battery of attention tests, learning to control video games by altering his brain waves, scanning his own brain with a \$2 million fMRI machine, all in search of a modern answer to the oldest of questions: who am I?

Along the way, Johnson explores how we "read" other people, how the brain processes frightening events (and how we might rid ourselves of the scars those memories leave), what the neurochemistry is behind love and sex, what it means that our brains are teeming with powerful chemicals closely related to recreational drugs, why music moves us to tears, and where our breakthrough ideas come from.

Johnson's clear, engaging explanation of the physical functions of the brain reveals not only the broad strokes of our aptitudes and fears, our skills and weaknesses and desires, but also the momentary brain phenomena that a whole human life comprises. Why, when hearing a tale of woe, do we sometimes smile inappropriately, even if we don't want to? Why are some of us so bad at remembering phone numbers but brilliant at recognizing faces? Why does depression make us feel stupid?

To read *Mind Wide Open* is to rethink family histories, individual fates, and the very nature of the self, and to see that brain science is now personally transformative -- a valuable tool for better relationships and better living.

Playing the Future: What We Can Learn from Digital Children

By Douglas Rushkoff

Three years after the original publication of *Playing the Future: What We Can Learn from Digital Children* in 1996, this breathlessly polemical defense of the techno-savvy youth culture of the '90s already reads like a document from another era. Back then the Internet was still a strange new force, instinctively embraced by children who'd grown up playing video games, instinctively distrusted by the grownups who ran the mainstream media. Standing up for the emergent digital culture--loosely associated with suspicious activities like raves, role-playing games, & piercing--took nerve & optimism.

And Douglas Rushkoff here supplies both in abundance. His argument: contemporary "screenagers," as he calls them, aren't being warped by new technologies, they're adapting to them. Their relationship to play, work, spirituality, & politics all reflect the contours of a new world shaped by the liberating logic of digital networks & chaos theory. It's a better world, Rushkoff assures us, & if the grownups know what's good for them, they will stop looking askance at the ways of digital youth & start trying to learn from them instead.

Ultimately, Rushkoff seems a lot more interested in making his argument than in making it stick. He flies from one loose logical connection to another--the secret link between fractal math & snowboarding, the parallel between Web browser interfaces & Federal Reserve notes--and he alternates between near-brilliance & utter implausibility as he goes.

But even nowadays, when the heated rhetoric that met the first wave of digital culture is generally giving way to more nuanced analysis, there's something contagious about Rushkoff's passionate faith that the children are all right. He may not convince you, but after this intellectual joy ride is over, that may not matter. Like any good child of the '90s, you'll want to believe.

How People Learn: Brain, Mind, Experience, & School

By National Research Council (Corporate Author), John Bransford (Editor), Ann L. Brown (Editor), Rodney R. Cocking (Editor)

Learning is such a natural thing for humans. In a matter of months, the typical human baby goes from being unable to make a sound to being able to understand & use language. After a few years, the neurological connections in their brains are largely completed & all of their senses become active. Many if not most of the basic sensations have been experienced & recorded. However, beyond the universal aspects of human learning, it becomes a very individual experience. The kind of learning that is done in school appears to be beyond what humans are genetically & physiologically designed to do, which means that it cannot be applied en masse. Unfortunately, that is what the public education strategy has been since it was implemented. The development of the factory, where workers had to be punctual, reliable & able to follow detailed instructions, meant that workers had to be interchangeable. Therefore, a public education was designed to be one that tried to mold everyone into the same final product using a standard approach to learning.

That strategy was actually very successful for almost a century, where the United States & other developed countries went from limited to almost universal literacy. However, in the last several decades, with the rapid development of new knowledge & specialties, that approach has proven inadequate. It is time to consider new ways of learning, & that begins with learning the different ways that humans learn.

The first step, described in detail in the book, is to understand that a newborn baby possesses more ability to learn than was ever realized before. Once experiments were developed that made it possible to measure feedback from infants, it was learned that they were far more aware of their world than previously thought. This is important, in that it demonstrates an important aspect of fundamental patterns of learning.

From much of the research cited in the book, it is clear that in our modern society, the standardized curriculum is counterproductive & standardized tests to measure the value of that curriculum are invalid. When the goal is to pass a standardized test, especially when there are penalties for failure, students & teachers alike naturally fall into a basic mindset to prepare for the test. This tends to create an emphasis on rote memorization, stifles learning, & prevents the development of an agile mindset. There is an enormous amount of research, much of which is cited in this book that strongly suggests that the best education is one where people are forced to resolve situations & problems that present a bit of uniqueness. Environments that are varied & present new situations on a regular basis lead to a greater amount of intellectual stimulation & smarter creatures. This holds for all animals, from rats to humans.

While technology can be a tremendous aid, it is not a cure-all. Like all strong medicine it must be administered in intelligent doses. That point is also covered very well in the book. One other very interesting point dealt with cultural differences. A speech-language pathologist was working in an Inuit school & one-third of the class was considered to be in need of assistance by a non-Intuit principal, "because they did not talk in class." However, the "problem" was resolved when the pathologist consulted an Inuit teacher, who cleared it up by saying, "Well-raised Inuit children should not talk in class. They should be learning by looking & listening."

This is a very important book for all people involved in education. The educational tactics that served us well in the past are no longer appropriate. By reading & studying the research findings summarized in this book, all stakeholders in education can learn how to more efficiently transfer knowledge into those who want it & need it.

How Students Learn: History, Mathematics, & Science in the Classroom

By Suzanne Donovan & John Bransford

This book has its roots in the report of the Committee on Developments in the Science of Learning, *How People Learn: Brain, Mind, Experience & School* (National Research Council, 1999, National Academy Press). That report presented an illuminating review of research in a variety of fields that has advanced understanding of human learning. The report also made an important attempt to draw from that body of knowledge implications for teaching. A follow-on study by a second committee explored what research & development would need to be done, & how it would need to be communicated, to be especially useful to teachers, principals, superintendents, & policy makers: *How People Learn: Bridging Research & Practice* (National Research Council, 1999). These two individual reports were combined to produce an expanded edition of *How People Learn* (National Research Council, 2000). I refer to this volume as HPL.

In the present book, the goal is to take the HPL work to the next step: to provide examples of how the principles & findings on learning can be used to guide the teaching of a set of topics that commonly appear in the K-12 curriculum. As was the case in the original work (1999), the book focuses on three subject areas: history, mathematics, & science. Each area is treated at three levels: elementary, middle, & high school. Distinguished researchers who have extensive experience in teaching or in partnering with teachers were invited to contribute the chapters. The committee shaped the goals for the volume, & commented-sometimes extensively on the draft chapters as they were written & revised. The principles of HPL are embedded in each chapter, though there are differences from one chapter to the next in how explicitly they are discussed. Taking this next step to elaborate the HPL principles in context poses a potential problem that we wish to address at the outset. The meaning & relevance of the principles for classroom teaching can be made clearer with specific examples. At the same time, however, many of the specifics of a particular example could be replaced with others that are also consistent with the HPL principles. In looking at a single example, it can be difficult to distinguish what is necessary to effective teaching from what is effective but easily replaced. With this in mind, it is critical that the teaching & learning examples in each chapter be seen as illustrative, not as blueprints for the "right" way to teach.

We can imagine, by analogy, that engineering students will better grasp the relationship between the laws of physics & the construction of effective supports for a bridge if they see some examples of well-designed bridges, accompanied by explanations for the choices of the critical design features. The challenging engineering task of crossing the entrance of the San Francisco Bay, for example, may bring the relationship between physical laws, physical constraints, & engineering solutions into clear & meaningful focus. But there are some design elements of the Golden Gate Bridge that could be replaced with others that serve the same end, & people may well differ on which among a set of good designs creates the most appealing bridge.

To say that the Golden Gate Bridge is a good example of a suspension bridge does not mean it is the only, or the best possible, design for a suspension bridge. If one has many successful suspension bridges to compare, the design features that are required for success, & those that are replaceable become more apparent & the requirements that are uniform across contexts, & the requirements that change with context, are more easily revealed.

The chapters in this volume highlight different approaches to addressing the same fundamental principles of learning. It would be ideal to be able to provide two or more "HPL compatible" approaches to teaching the same topic (for example, the study of light in elementary school). However, we cannot provide that level of specific variability in this

already lengthy volume. Nevertheless, we hope that common features across chapters, & the variation in approach among the chapters, are sufficient to provide instructive insights into the principles laid out in *How People Learn*. Substantial parts of the books can be downloaded from

<http://lab.nap.edu/nap-cgi/discover.cgi?term=how+students+learn&GO.x=18&GO.y=5&restric=NAP>

How the Brain Learns, 2nd Edition (Text & Manual)

by David A. Sousa

David Sousa's practical and powerful bestseller on brain research and education enters the 21st century with a valuable updated edition, incorporating the previously published main text, the companion manual, and the latest discoveries in neuroscience and learning. *How the Brain Learns* has always focused on the information that can help teachers turn research on brain function into practical classroom activities and lessons. The second edition still includes basic brain facts that can help students learn, insights on how the brain processes information, and tips on maximizing retention using "down time." And now Sousa takes it further, building on the latest information available to provide:

An updated Information Processing Model that reflects new terminology regarding the memory system
Exciting new research on how the brain learns motor skills
A whole new chapter on the implications of the arts in learning
An expanded list of primary sources for those who wish to review the core research

All the newest information and insights are included. It's a vital tool for school leaders, staff developers, teacher educators, and administration education faculty—as well as any educator who wants to help students learn.

How the Brain Learns to Read

by David A. Sousa

How the Brain Learns to Read presents what scientists have uncovered about how children develop spoken language and use spoken language abilities when learning to read. Best-selling author David Sousa explores source material on brain research and provides scores of practical reading strategies for the K-12 classroom. Complete with relevant brain diagrams and informative tables, this exciting new book examines critical concepts including:

- Understanding language acquisition and its relationship to reading
- Incorporating modern research findings in your classroom
- Overcoming reading problems, including early intervention programs
- Content area reading with strategies to improve vocabulary and comprehension
- Developing successful reading programs that encourages teachers to be researchers

Reading is essential for success in our society. With this guide to cutting-edge reading research, you'll find the keys to unlocking reading success in your students!

How the Special Needs Brain Learns

by David A. Sousa

Now from the author of the best-selling *How the Brain Learns* comes a new book dealing with special needs students. *How the Special Needs Brain Learns* helps you turn research on the brain function of students with various learning challenges into practical classroom activities and strategies.

David Sousa shows how the brain processes information and examines both simple and complex learning strategies that can be adapted and taught to your students. The first step for students with learning disabilities is helping them to build self-esteem by teaching them how to work in groups and giving them strategies for engagement and retention. This book focuses on the most common challenges to learning for many students, especially for those who are often the first candidates for special education referral, and emphasizes lifelong independent learning, increased retention, and cognitive flexibility for all. Sousa builds on the latest brain research to discuss teaching strategies for students challenged by:

- ADHD/ADD
- Speech disabilities
- Reading disabilities
- Writing disabilities
- Math disabilities
- Sleep disorders
- Emotional and behavioral disorders
- Autism
- Asperger's Syndrome

Today's classrooms embrace students of all abilities, and Sousa's latest work provides the most up-to-date information and insight on how to work effectively with each one of them. Offering real strategies for real classrooms, *How the Special Needs Brain Learns* is an indispensable tool for all educators, school administrators and teachers, staff developers, pre-service educators, and even parents who want to better understand the way their children process and retain information.

Becoming a "Wiz" at Brain-Based Teaching

by [Marilee Sprenger](#)

Through the clever analogy of *The Wizard of Oz*, Marilee Sprenger provides invaluable information about cognitive research and shares simple tactics for implementing these ideas in the classroom. Learn proven tools for coping with "the Lion's stress, the Tin Woodsman's need for emotional intelligence, and the Scarecrow's desire for higher level

thinking."

This user-friendly guide effectively discusses expert findings about brain growth, structure, and functions to help teachers and administrators foster a love of learning in all students. By creating an enriched, brain-compatible environment as outlined in this book, educators can effectively counter such existing negative influences as stress, sleep deprivation, poor nutrition, and a genetic predisposition to disorders in order to cultivate successful lifelong learning.

Key features include:

1. Straightforward discussion about memory pathways, learning styles, and multiple intelligences
2. Extensive examples from real school situations where brain research has been applied
3. Tactics for immediately putting brain-based information to work in the classroom
4. Concrete techniques for using music, teams, rapport building, and brain-state changes to stimulate student learning

TRENDS

The World Is Flat: A Brief History of the Twenty-first Century

by Thomas L. Friedman

Thomas Friedman is not so much a futurist, which he is sometimes called, as a presentist. His aim, in his new book, *The World Is Flat*, as in his earlier, influential *Lexus and the Olive Tree*, is not to give you a speculative preview of the wonders that are sure to come in your lifetime, but rather to get you caught up on the wonders that are already here. The world isn't going to be flat, it *is* flat, which gives Friedman's breathless narrative much of its urgency, and which also saves it from the Epcot-style polyester sheen that futurists--the optimistic ones at least--are inevitably prey to.

What Friedman means by "flat" is "connected": the lowering of trade and political barriers and the exponential technical advances of the digital revolution have made it possible to do business, or almost anything else, instantaneously with billions of other people across the planet. This in itself should not be news to anyone. But the news that Friedman has to deliver is that just when we stopped paying attention to these developments--when the dot-com bust turned interest away from the business and technology pages and when 9/11 and the Iraq War turned all eyes toward the Middle East--is when they actually began to accelerate. Globalization 3.0, as he calls it, is driven not by major corporations or giant trade organizations like the World Bank, but by individuals: desktop freelancers and innovative startups all over the world (but especially in India and China) who can compete--and win--not just for low-wage manufacturing and

information labor but, increasingly, for the highest-end research and design work as well. (He doesn't forget the "mutant supply chains" like Al-Qaeda that let the small act big in more destructive ways.) Friedman tells his eye-opening story with the catchy slogans and globe-hopping anecdotes that readers of his earlier books and his *New York Times* columns will know well, and also with a stern sort of optimism. He wants to tell you how exciting this new world is, but he also wants you to know you're going to be trampled if you don't keep up with it. His book is an excellent place to begin

The Singularity Is Near: When Humans Transcend Biology

by Ray Kurzweil

In my presentations I frequently refer to an amazing book entitled *The Age of Spiritual Machines*, by the great inventor & futurist Ray Kurzweil. Kurzweil is one of the best-known & controversial advocates for the role of machines in the future of humanity. In his latest, thrilling foray into the future, he envisions an event - the "singularity" - in which technological change becomes so rapid & so profound that our bodies & brains will merge with our machines.

The Singularity Is Near portrays what life will be like after this event - a human-machine civilization where our experiences shift from real reality to virtual reality & where our intelligence becomes non-biological & trillions of times more powerful than unaided human intelligence. In practical terms, this means that human aging & pollution will be reversed, world hunger will be solved, & our bodies & environment transformed by nanotechnology to overcome the limitations of biology, including death.

We will be able to create virtually any physical product just from information, resulting in radical wealth creation. In addition to outlining these fantastic changes, Kurzweil also considers their social & philosophical ramifications. With its radical but optimistic view of the course of human development, *The Singularity Is Near* is certain to be one of the most widely discussed & provocative books of 2005.

Information Anxiety 2

by Richard Saul Wurman, David Sume, Loring Leifer

Information might want to be free; but why should we free it? We've got enough trouble keeping track of all the petabits that already run around untethered, & risk a computer counterrevolution if we let the situation get much crazier. Information architect Richard Saul Wurman swept the field clear in 1989 with his groundbreaking book that foresaw the problems of data clutter & proposed a radical new means of organizing & presenting knowledge humanistically; for the new century, he has revised it substantially as *Information Anxiety 2*. This book is sparkingly clear & readable--it'd better be, after all--and offers insight not only to designers, educators, & content developers, but also to

anyone who needs to communicate effectively through dense clouds of facts. If Wurman occasionally indulges in New Age-y pop psychology, his analysis is never muddy, & the more hardheaded reader will forgive him soon enough. The discussion alternates between describing the deeply stressful task of absorbing poorly organized data & exploring solutions that require a bit of rethinking, but that reward such an investment with improved understanding and, maybe, a state change from information to wisdom. We could do worse--if we don't pay attention to Wurman & his colleagues, we almost certainly will.

The Tipping Point: How Little Things Can Make a Big Difference

by Malcolm Gladwell

"The best way to understand the dramatic transformation of unknown books into bestsellers, or the rise of teenage smoking, or the phenomena of word of mouth or any number of the other mysterious changes that mark everyday life," writes Malcolm Gladwell, "is to think of them as epidemics. Ideas and products and messages and behaviors spread just like viruses do." Although anyone familiar with the theory of memetics will recognize this concept, Gladwell's *The Tipping Point* has quite a few interesting twists on the subject.

For example, Paul Revere was able to galvanize the forces of resistance so effectively in part because he was what Gladwell calls a "Connector": he knew just about everybody, particularly the revolutionary leaders in each of the towns that he rode through. But Revere "wasn't just the man with the biggest Rolodex in colonial Boston," he was also a "Maven" who gathered extensive information about the British. He knew what was going on and he knew exactly whom to tell. The phenomenon continues to this day--think of how often you've received information in an e-mail message that had been forwarded at least half a dozen times before reaching you.

Gladwell develops these and other concepts (such as the "stickiness" of ideas or the effect of population size on information dispersal) through simple, clear explanations and entertainingly illustrative anecdotes, such as comparing the pedagogical methods of *Sesame Street* and *Blue's Clues*, or explaining why it would be even easier to play Six Degrees of Kevin Bacon with the actor Rod Steiger. Although some readers may find the transitional passages between chapters hold their hands a little too tightly, and Gladwell's closing invocation of the possibilities of social engineering sketchy, even chilling, *The Tipping Point* is one of the most effective books on science for a general audience in ages. It seems inevitable that "tipping point," like "future shock" or "chaos theory," will soon become one of those ideas that everybody knows--or at least knows by name.

CURRICULUM & LEARNING

Teaching for Tomorrow: Teaching Content & Problem-Solving Skills

by Ted McCain

Although I may seem a bit biased in that he co-authored *Windows on the Future* with me, I truly believe that Ted McCain understands the big picture in education better than just about anyone out there. And if you've ever got the opportunity to hear him speak, you'll know exactly what I'm talking about.

This said, if you're frustrated with the direction education appears to be heading - if you feel an overwhelming need to reconsider the relevancy of what you teach - or if you want to discover how to get students to develop "real-world" problem-solving skills, you'll definitely want to read Ted's new book *Teaching For Tomorrow: Teaching Content & Problem-Solving Skills* (2005, Corwin Press)

Through first-hand experience, Ted concisely lays out the argument for preparing students for their world, guiding them to become independent & successful critical thinkers. *Teaching for Tomorrow* brings everyday life encounters & situations as text to the classroom, challenging students to engage more deeply in their learning & teachers in their teaching. By eliminating the typical stand & deliver approach, Ted hopes educators will now focus on using instruction that allows students to create knowledge for themselves.

Major components of the book include:

1. Role-playing scenarios
2. Mapping out 6 changes to teaching that enable teachers to use problem-solving, project-based instruction effectively
3. The outline of the 4 D's (Define, Design, Do, & Debrief), a step-by-step process for student work & for problem solving applicable to virtually any field

By gaining real-world skills rather than just "school" skills, students are engaged in thoughtful work, learning to collaborate, taking responsibility for their own time & tasks, & becoming creative problem solvers in the classroom & for life beyond. This book is HIGHLY recommended.

What Every Teacher Should Know: The 10 Book Collection

by Donna Walker Tileston

This slipcase collection of 10 compact volumes offers a complete training curriculum for teachers that covers all required essentials for teacher induction, mentoring, and support programs. The collection can be used for teacher certification and re-certification programs, as well as for fast-track alternative certification programs.

Additional highlights embedded within each individual volume include assessment pre-tests and post-tests, resources, and content about urban learners, making this training program ideal for preparing highly qualified teachers for today's challenging classrooms, particularly in urban areas.

The entire collection allows instructors and staff developers to offer comprehensive teacher training that meets the requirements of the *No Child Left Behind* legislation. Individual works can be purchased separately and cover "*What Every Teacher Should Know About . . .*"

1. ***Diverse Learners***—research-based approaches to working with diverse learners
2. ***Student Motivation***—steps teachers can take to motivate and challenge students
3. ***Learning, Memory and the Brain***—a holistic approach to student learning
4. ***Instructional Planning***—long and short-term goals for lesson planning
5. ***Effective Teaching Strategies***—a bag of teaching tools for the written, taught, and assessed curriculum
6. ***Classroom Management and Discipline***—effective tools to minimize or prevent the most common discipline problems
7. ***Student Assessment***—and the implications of standards-based instruction in the classroom
8. ***Special Learners***—effective tools to help students with special needs achieve school success
9. ***Media and Technology***—media that work for each of the student modalities
10. ***The Profession and Politics of Teaching***—effective partnerships with parents, teaching peers, mentor teachers, administrators, and teacher organizations

Understanding by Design

by Grant Wiggins, Jay McTighe

McTighe & Williams successfully expound on a subject often mired in philosophical debate: how to assess understanding & evaluate true learning. It is an outstanding framework for developing curriculum intent on extending beyond traditional methods of teaching & preaching to students. The authors contend that measuring performance against six facets of understanding can assess true understanding: explanation, interpretation, application, perspective, empathy, & self-knowledge. These facets are vital to developing curriculum & the authors do an outstanding job of presenting the material in charts, & exercises, making a difficult topic easier to understand. Comparing & contrasting covering material & uncovering knowledge serves to help teachers think like assessors, rather than activity planners. Helpful design tools are included throughout the book & teachers are instructed to evaluate the effectiveness of their teaching with thoughtful & probing questions.

Understanding by Design will serve as my guide for evaluating my own effectiveness as a teacher. I expect to rely on it to gauge my own competency in developing & executing lessons. Examples throughout the book illuminating the practical applications of each of the six facets are well organized & easy to follow. I found the use of keywords & charts especially helpful in furthering my own understanding of how to uncover knowledge. I am confident that if I remain faithful to the tenets of this book, I will be able to put into practice what I believe constitutes effective strategies for learning: student-centered activities which call upon students to question assumptions, draw upon past knowledge, & advance understanding through incremental learning. A series of field books are also available.

Results: The Key to Continuous School Improvement

by Mike Schmoker

A terrific book that tangible, measurable results are the key to school improvement. Under the right conditions, schools can bring about incremental, even dramatic results. Author Mike Schmoker examines these conditions & the theory behind them, using examples from schools to show that virtually any school can begin to successfully replicate the conditions. Meaningful teamwork, when combined with setting clear, measurable goals & regularly collecting & analyzing a wide variety of contextualized qualitative and/or quantitative performance data, constitutes the foundation for results. Schmoker emphasizes the importance of principals & practices that are simple, supported by research, & relatively few in number. Such principals have enormous but under-used potential. As the many schools described in this book demonstrate, educators can immediately provide a better education for all students by focusing unwaveringly on better results & the conditions that promote them. A field book is also available.

For further reading (in no particular order):

1. *Learning and Memory: The Brain in Action* by [Marilee Sprenger](#)
2. *Completing the Puzzle: The Brain-Compatible Approach to Learning* by Eric Jensen
3. *Bowling Alone: The Collapse and Revival of American Community*, Robert Putnam, Touchstone Books, 2001, ISBN: 0743203046
4. *Diffusion of Innovations*, 4th Edition, Everett Rogers, Free Press, 1995, ISBN: 0029266718
5. *Information Anxiety 2*, Richard Saul Wurman, Que Publishing, 2000, ISBN: 0789724103
6. *Minds, Brains, and Learning, Understanding the Psychological and Educational Relevance of Neuroscientific Research* by James P. Byrnes, Guilford Press, 2001, ISBN: 1572306521
7. *Taming the Beast: Choice and Control in the Electronic Jungle* by Jason Ohler, Technos Press, 2000, ISBN: 0784298735
8. *Growing Up Digital: The Rise of the Net Generation* by Don Tapscott, McGraw-Hill, 1997, ISBN: 0070633614
9. *Who Moved My Cheese? An Amazing Way to Deal With Change in Your Work and in Your Life* by Spencer Johnson & Kenneth Blanchard, Penguin USA; 1999 ISBN: 0399144463
10. *How the Brain Learns*, by David Sousa, Corwin Press, 2001, ISBN: 0761977651
11. *How the Special Needs Brain Learns*, by David Sousa, Corwin Press, 2001, ISBN: 0761978518
12. *How People Learn: Brain, Mind, Experience, and School*, by John D. Bransford (Editor), Ann L. Brown (Editor), Rodney R. Cocking, John B. Bransford (Editor) National Academy Press, 1999, ISBN: 0309065577
13. *Schools That Learn: A Fifth Discipline Fieldbook*, Peter Senge editor, Doubleday, 2000, ISBN: 0385493231
14. *A Schema-Theoretic View of Basic Processes in Reading Comprehension Handbook of Reading Research*, by Anderson, R.C., & Pearson, P.D. (1984). (Pearson, Ed.) Longman, New York, NY:
15. *Nature's Mind*, by Gazzaniga, M., Basic Books, 1992, New York, NY:.
16. *The Owner's Manual For the Brain*, Howard, P.J., Bard Press, 2000, Austin, TX:
17. *Introduction to Brain-compatible Learning*, Jensen, E., The Brain Store, 1998, Del Mar, California:.
18. *Completing the Puzzle: The Brain-compatible Approach to Learning*, Jensen, E. The Brain Store, 1997, Del Mar, California.
19. *Inside the Brain*, Kotulak, R., Andrews McMeel, 1996, Kansas City, MO.

20. *Classroom Instruction That Works*, Marzano, R.J., Pickering, D.J. and Pollock, J.E., ASCD, 2003, Alexandria, VA.:
21. *A Theory-based Meta-analysis of Research on Instruction*, Marzano, R. 1998, Mid-continent Regional Educational Laboratory Aurora, CO.
22. *Dimensions of Learning*, Marzano, R.J. et al, 1992, ASCD, Alexandria, VA
23. *A Different Kind Of Classroom: Teaching With Dimensions Of Learning*, Marzano, R.J., 1992, ASCD, Alexandria, VA
24. *A Framework For Understanding Poverty*, Payne, R.K. 2001. Aha! Process Inc., Highlands, Texas:
25. *How The Brain Learns: New Insights Into The Teaching/Learning Process*, Sousa, D. 1997, Audiotape. National Association of Secondary School Principals, Reston, VA:
26. *How The Brain Learns*, Sousa, D., 1995, National Association of Secondary School Principals, Reston, VA.
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